PHILIPS

AC Current Probe

PM9355

TEST & MEASUREMENT CUSTOMER SUPPORT

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900907

Instruction Manual

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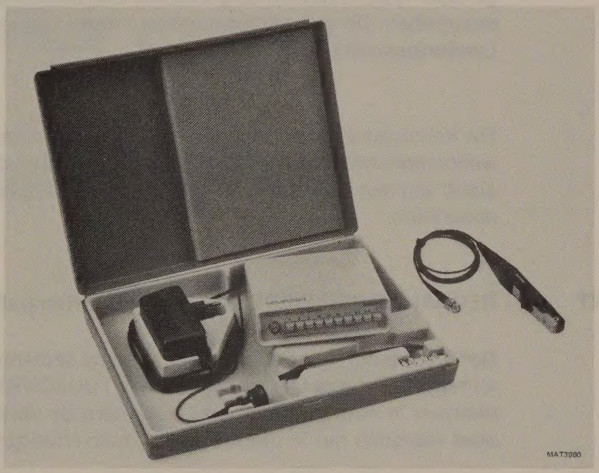

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IMPORTANT **In correspondence concerning this instrument please quote the typenumber and serial number as given on the type plate.**

Note: *The design of this instrument in subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

WICHTIG **Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.**

HINWEIS: *Die Konstruktion und Schaltung dieses Geräts wird ständig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

IMPORTANT **RECHANGE DES PIECES DETACHEES (Réparation).**

Dans votre correspondence et dans vos réclamations se rapportant à cet appareil, veuillez TOUJOURS indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

REMARQUES: *Cet appareil est l'objet de développements et améliorations continuels. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

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SHIPMENT NOTE

The following parts should be included in the shipment:
- 1 PM9355 AC current probe
- 1 PM9355 current probe amplifier with mains adapter
- 1 PM9585 50 Ω termination
- 1 Earth cable
- 1 Carrying case with insert
- 1 Instruction manual

INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or there is damage, a claim should be filed with the carrier immediately, and the PHILIPS/ FLUKE Sales or Service organisation should be notified in order to facilitate the repair or replacement of the instrument.

Thank you for purchasing this Philips PM9355 AC Current probe and amplifier. It has been designed and manufactured to the highest quality standards to give many years of trouble free and accurate measurements.

Should you have any comments on how this product could be improved then please contact your local Fluke/Philips organisation.

INTRODUCTION

The PM9355 AC Current probe is an alternating-current measuring device consisting of a clip-on current transformer and a frequency-compensated amplifier. The latter incorporates the measuring range switches.

The current probe is intended for use with oscilloscopes having a 50 Ω input impedance. Oscilloscopes with a 1 MΩ impedance may also be used, but only in combination with the supplied 50 Ω termination.

The output BNC of the amplifier is provided with a range indicator, which sets the oscilloscope to an initial attenuator setting of 20 mV/div.

The circuits of the probe are powered from the a.c. mains (line) supply.

1 OPERATORS SAFETY

ATTENTION: Read this page carefully before installation and use of the instrument.

1.1 INTRODUCTION

The instrument described in this manual is designed to be used by properly-trained personnel only. Adjustment, maintenance and repair of the exposed equipment shall be carried out only by qualified personnel.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally-accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

Caution: **Is used to indicate correct operating or maintenance procedures in order to prevent damage to or destruction of the equipment or other property.**

WARNING: **Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.**

1.4 SYMBOLS

Read the operating instructions.

Protective earth (grounding) terminal (black)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety-protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

2 INSTALLATION INSTRUCTIONS

ATTENTION: You are strongly advised to read this chapter thoroughly before installing your AC current probe and amplifier.

2.1 INSTALLATION

Before plugging the amplifier into an oscilloscope, ensure that the safety regulations outlined below are strictly adhered to.

2.2 SAFETY INSTRUCTIONS (IN ACCORDANCE WITH IEC 348).

2.2.1 Earthing (Grounding)

Before connecting the instrument to the mains (line), visually check the cabinet, controls and connectors, etc., to ascertain whether any damage has occured in transit. If any defects are apparent, do not connect the instrument to the mains (line).

The instrument must be disconnected from all voltage sources before any maintenance or repair work is carried out.

If adjustments or maintenance of the operating instrument with covers removed is inevitable, it must be carried out only by a qualified person who is aware of the hazards involved. In normal operation the double insulated power supply obviates the need for a safety ground.

WARNING: It must be borne in mind that in all measurements the frame ground of the AC current probe and amplifier is raised to the same potential as that of the measuring ground probe connection. Neither the probe's ground lead nor the frame ground shall be connected to live potentials.

EARTHING: If the AC current probe transformer is clamped around a conductor which has a potential higher than 30 V (r.m.s.) or 42,4 V (dc and ac peak), the earth screw at the rear of the amplifier must be properly grounded.

2.2.2 Mains (line) voltage setting

The mains adaptor is provided with a mains (line) voltage selection, which enables you to operate on the 110 V or 220 V mains (line) voltages.

Before connecting the instrument to the mains (line), make sure that it is set to the local mains (line) voltage. On delivery it is set to 220 V. If the instrument has to be used with 110 V supply, the appropriate voltage should be selected by turning the switch on the rear of the mains adaptor by means of a screwdriver. The selected voltage is indicated in the window of the mains adapter.

WARNING: The instrument shall be disconnected from all voltage sources when the mains adaptor has to be adapted to a different mains (line) voltage.

3 OPERATING INSTRUCTIONS

3.1 SWITCHING ON THE INSTRUMENT

Before connecting the instrument to the mains (line), the instructions given in Section 2.1. (installation) should be carefully observed.
When the mains adaptor is connected to the mains (line), the PM9355 is immediately ready for use. Normally, after a 15-minute warm-up period, the instrument will meet its specifications. However, if the instrument has been subjected to an extremely cold environment (e.g. left in a car overnight in freezing conditions) and then brought into a warm room, a warm-up period of sufficient lenght should be allowed.

3.2 INITIAL CONNECTIONS

Connect the cable of the AC current probe to the BNC input socket of the amplifier box. Connect the output cable of the amplifier to the vertical input BNC of the oscilloscope; if necessary, use the 50 Ω termination when the oscilloscope's input is 1 MΩ. Connect then the mains adapter to the mains (line). Finally switch-on the oscilloscope. When the oscilloscope is provided with a range indication, the attenuator sensitivity is automatically set to 20 mV/div and the input impedance is set to 50 Ω (only effective at oscilloscopes with 50 Ω input facility)

If necessary, the delivered earth cable can be used to minimize ringing in a signal. This cable must **first** be plugged on the earth connection on top of the current probe and then be connected to the nearest earth point of the circuit to be measured.

3.3 DIRECTION OF CURRENT FLOW

Conventional current (flowing from + to -) flowing in the direction of the arrow on the probe will cause an upward deflection on the screen of the oscilloscope. This applies only, of course, if the signal polarity has not been inverted by means of the NORM/INVERT control of the oscilloscope.

3.4 LOADING OF THE CIRCUIT UNDER TEST

Whenever possible, clamp the AC current probe around the low-potential or earth end of a component lead. In this way, loading of critical circuits and display of noise and interference will be minimized.

3.5 PROBE SLIDER

The probe slider is used to open the clip-on transformer core in the probe tip and to close it around the conductor under test. This conductor then acts as the primary of the current transformer.

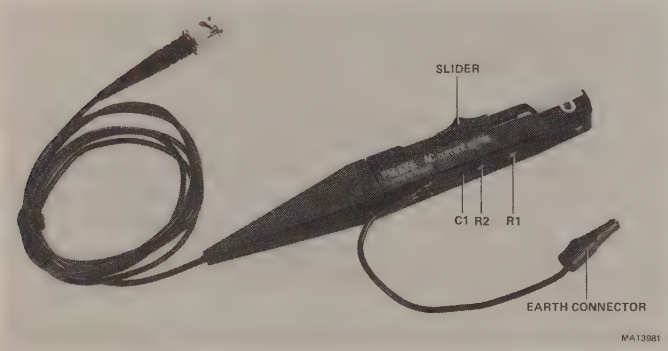

Figure 3.1 AC current probe

Make sure that during the measurements the slider is pushed all the way foreward, the word ON visible, as this quarantees the maximum contact between the moveable and stationary part of the transformer core. If the slider has not been pushed all the way foreward, large l.f. errors may occur.

As an extra protection to the circuit under test, the screening around the transformer core is only connected to earth when the slider is in the foremost (ON) position. In this way, accidental short circuits to earth are prevented when the probe is clamped around the conductor under test.

3.6 INTERFERENCE

Do not clamp the AC current probe transformer around a conductor which is part of a current loop with a large area. This loop picks up interference which will be displayed together with the signal. If it is inevitable to measure in in a large loop, the order of magnitude of the interference may be obtained by leaving the probe around the conductor and switching off the test current. The signal which is then displayed, is the picked-up interference. It is also possible to determine the interference by a differential measurement. Clamp to this end the AC current probe transformer around both the foreward and return conductor at the same time.

3.7 HIGH CURRENTS

If high currents are measured, never disconnect the AC current probe transformer from the amplifier box or from its termination when it is still clamped around the conductor under test. When the probe cable is not terminated in this condition, a very high voltage which is likely to damage the current transformer is produced in the secundary winding.

3.8 USING THE AC CURRENT PROBE ONLY

The AC current probe may be used as a separate part on an oscilloscope with a 50 Ω input impedance or via the 50 Ω termination. Bear in mind, however, that the transformation ratio is 99 : 1 for the probe only instead of 100 : 1, when the probe is used together with the amplifier. This means that for the probe only, the output signal is not 0,5 V/A but 0,505 V/A. The overall deflection coefficient may be found in this case by multiplying $^{99}/_{50}$ A/V by the deflection coefficient the oscilloscope.

Example: **Oscilloscope setting 20 mV/div.**
The overall deflection coefficient is then:
$^{99}/_{50}$ A/V x 20 mV/div = 39,6 mA/div

If desired, the oscilloscope's gain may be changed to make up a ratio of 100 : 1. Clamp to this end the probe around the CAL current loop of the oscilloscope and readjust the overall gain of the oscilloscope to obtain the required trace height.

3.9 USING THE PROBE-AMPLIFIER COMBINATION

When using the AC current probe together with the delivered amplifier, the entire deflection coefficient is indicated on the push-button labels at the front of the amplifier. Thus a current range is obtained from 1 mA/div ... 1 A/div. Bear in mind that these coefficients are only valid when the test oscilloscope has a sensitivity of 20 mV/div.

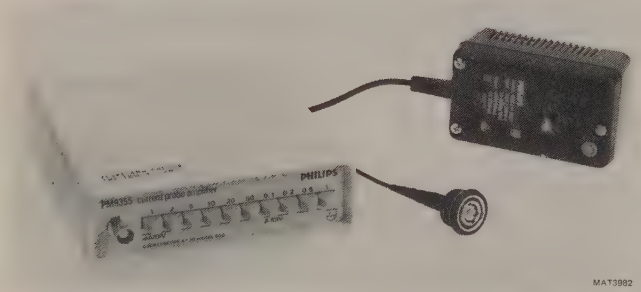

Figure 3.2 Amplifier box

3.10 INSERTION IMPEDANCE

The insertion impedance of the current probe is the equivalent circuit that is inserted into the current path when the AC current probe transformer is clamped around the conductor under test. The equivalent circuit is shown in Figure 3.3. In the flat part of the frequency characteristic, the insertion impedance is approximately 50 Ω/ 99^2 turns ≈ 5 mΩ.

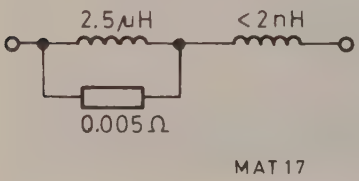

Figure 3.3 Equivalent circuit forming the insertion impedance

3.11 MEASURING HINTS

3.11.1 Increasing the sensitivity

The current sensitivity may be increased by increasing the number of primary turns. Looping the conductor under test through the current transformer twice results in an increase of the secundary current by a factor of two, since the current ratio in a transformer is inversely proportional to the turns ratio.
However, bear in mind that the insertion impedance which comes in series with the circuit being measured varies as the square of the primary turns.
The sensitivity may also be increased by setting the oscilloscope's deflection coefficient to a lower value. If the coefficient is set to 10 mV/div, the sensitivity for currents is increased by a factor of two.
A disadvantage, however, is the display of more noise.

3.11.2 Decreasing the sensitivity

In order to measure higher currents than the specified maximum peak-to-peak current of 12 A, the current sensitivity of the probe may be decreased as follows:

Interrupt the conductor of which the high current must be measured. Take two, three or more pieces of identical wire, cut them to approximately 10 cm and solder the wires together at both ands, in such a fashion that a conductor of two, three or more wires in parallel is obtained. Close the current path by bridging the interruption of the current path by means of the wire assembly. Clamp the AC current probe transformer around ONE of the wires of the assembly. If the assembly consists of two wires, the current through the probe will be half of the current through the conductor, one third of the current if the assembly consists of three wires, and so on.

D

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LIEFERUNGSHINWEIS

Die Sendung muss folgende Teile enthalten:
- 1 Wechselstromzange PM9355
- 1 Verstärker mit Netzspannungsadapter PM9355
- 1 50-Ω-Durchgangsabschluss PM9355
- 1 Erdungsleitung
- 1 Aufbewahrungskästchen mit Einsatz
- 1 Bedienungsanleitung

ERSTE PRÜFUNG

Prüfen Sie den Inhalt der Sendung auf Vollständigkeit und legen Sie eventuelle Transportschäden schriftlich fest. Falls die Sendung nicht komplett oder beschädigt ist, muss dies dem Transportunternehmen sofort mitgeteilt werden und ist die PHILIPS/FLUKE Verkaufs- und Service-Organisation zu benachrichtigen, damit das Gerät repariert oder ersetzt wird.

Wir danken Ihnen für den Erwerb dieses Philips PM9355 Wechselstromzange. Diese Wechselstromzange PM9355 mit Verstärker von Philips wurde so entworfen und gefertigt, dass sie den höchsten Qualitätsansprüchen entspricht und Sie ohne Probleme viele Jahre lang genaue Messungen durchführen können.

Sollten Sie Anmerkungen oder eventuelle Verbesserungsvorschläge zu diesem Produkt haben, wenden Sie sich bitte an Ihre örtliche Philips/Fluke Organisation.

EINLEITUNG

Die Stromzange PM9355 ist ein Wechselstrom-Messgerät, dass aus einem auftrennbaren Stromtransformator und einem frequenzkompensierten Verstärker besteht. Am Verstärker befinden sich die Schalter zum Wählen des Messbereichs.

Die Stromzange ist für Oszilloskope mit einer Eingangsimpedanz von 50 Ω vorgesehen. Bei Verwendung des mitgelieferten 50-Ω-Durchgangsabschlusses können aber auch Ozilloskope mit 1 MΩ Eingangsimpedanz eingesetzt werden.

Der BNC-Ausgang des Verstärkers ist mit einer elektronischen Bereichskennung ausgestattet, die den Eingangsabschwächer des Oszilloskopes auf 20 mV/div einstellt.

Die Schaltungen der Stromzange werden mit Netzstrom (Wechselstrom) versorgt.

1 SICHERHEIT

ACHTUNG: Lesen Sie diese Seite vor dem Anschliessen und der Inbetriebnahme des Gerätes sorgfältig durch.

1.1 EINLEITUNG

Das hier beschriebene Gerät sollte nur von entsprechend ausgebildeten Personen bedient werden. Einstellungen, Wartungsarbeiten und Reparaturen am geöffneten Gerät dürfen nur von einem Fachmann ausgeführt werden.

1.2 SICHERHEITSHINWEISE

Wie bei allen technischen Geräten sind auch bei diesem Gerät einwandfreie Funktion und Betriebssicherheit nur dann gewährleistet, wenn bei der Bedienung und beim Service sowohl die allgemein üblichen Sicherheitsvorkehrungen als auch die speziellen Sicherheitshinweise in dieser Bedienungsanleitung beachtet werden. Soweit erforderlich, enthält die Bedienungsanleitung spezielle Warn- und Vorsichtshinweise. Die entsprechenden Stellen des Gerätes sind mit warnenden Hinweisen und Symbolen gekennzeichnet.

1.3 VORSICHTS- UND WARNHINWEISE

Vorsichtshinweise: **Sollen auf eine korrekte Bedienung oder Wartung hinweisen, damit weder dieses Gerät noch andere daran angeschlossene beschädigt werden.**

Warnhinweise: **Geben eine potentielle Gefahrenquelle an, durch die bei unsachgemässer Behandlung für Bedienungspersonal oder Dritte gefährliche Situationen entstehen können.**

1.4 SYMBOLE

Lesen Sie die Bedienungsanweisungen!

Schutzerde-Anschluss (schwarz)

1.5 BEEINTRÄCHTIGUNG DER SICHERHEIT

Wenn aus irgendeinem Grunde angenommen werden kann, dass die Sicherheit beeinträchtigt ist, muss das Gerät ausser Betrieb gesetzt und so gekennzeichnet werden, dass es nicht versehentlich von Dritten wieder in Betrieb genommen wird. Ausserdem ist der Kundendienst zu benachrichtigen. Die Sicherheit kann z.B. beeinträchtigt sein, wenn das Gerät nicht einwandfrei funktioniert oder sichtbar beschädigt ist.

2 INSTALLATIONSANWEISUNGEN

ACHTUNG: Es wird dringend empfohlen, dieses Kapitel vor der Installation von Stromzange und Verstärker sorgfältig durchzulesen.

2.1 INSTALLATION

Vor dem Anschliessen des Verstärkers an das Oszilloskop ist sicherzustellen, dass die nachstehenden Sicherheitsanweisungen genau befolgt wurden.

2.2 SICHERHEITSANWEISUNGEN (GEMÄSS IEC 348)

2.2.1 Erdung

Vor dem Anschluss des Gerätes an das Netz müssen Gehäuse, Bedienelemente, Anschlüsse usw. auf eventuelle Transportschäden geprüft werden. Wird ein Schaden oder Defekt festgestellt, darf das Gerät nicht an das Netz angeschlossen werden.

Vor der Durchführung von Wartungs- oder Reparaturarbeiten muss das Gerät von allen Spannungsquellen getrennt werden.
Wenn Einstellungen oder Wartungsarbeiten am geöffneten und eingeschalteten Gerät vorgenommen werden müssen, dürfen diese Arbeiten nur durch einen Fachmann ausgeführt werden, der sich der damit verbundenen Gefahr bewusst ist. Bei normalem Betrieb ist kein Schutzerde-Anschluss erforderlich, da ein doppelt isoliertes Netzteil verwendet wird.

WARNUNG: Es ist zu beachten, dass die Gehäusemasse der Wechselstromzange und des -verstärkers bei allen Messungen auf das gleiche Potential angehoben wird wie die Messbezugsspannung. Weder die Masseleitung der Stromzange noch die Gehäusemasse dürfen mit stromführenden Potentialen in Verbindung kommen.

ERDUNG: Wenn die Stromzange an einen Leiter geklemmt wird, dessen Potential mehr als 30 V_{eff} oder 42,4 V (Gleichspannung und WechselspannungsSpitze) beträgt, muss die Erdungsschraube an der Rückseite des Verstärkers ordnungsgemäss geeerdet werden.

2.2.2 Einstellung der Netzspannung

Mit dem Netzspannungsadapter kann eingestellt werden, ob das Gerät bei einer Netzspannung von 110 V oder 220 V betrieben werden soll.

Vor dem Anschluss des Gerätes an die Netzspannung ist sicherzustellen, dass das Gerät auf die örtliche Netzspannung eingestellt ist. Bei Lieferung ist das Gerät auf eine Netzspannung 220 V eingestellt. Wenn es mit einer Netzspannung von 110 V betrieben werden soll, ist der Schalter an der Rückseite des Netzspannungsadapters mit einem Schraubendreher auf diese Spannung einzustellen. Die eingestellte Netzspannung wird im Fenster des Netzspannungsadapters angezeigt.

WARNUNG: Vor dem Einstellen der Netzspannung am Netzspannungsadapter muss das Gerät von allen Spannungsquellen getrennt werden.

3 BEDIENUNGSANWEISUNGEN

3.1 EINSCHALTEN DES GERÄTES

Vor dem Anschliessen des Gerätes sind die Anweisungen in Abschnitt 2.1 (Installation) genau zu befolgen.
Nach dem Anschliessen des Netzspannungsadapters an die Netzspannung ist das Gerät sofort betriebsbereit. Nach einer Anwärmzeit von 15 Minuten werden normalerweise die typischen technischen Daten eingehalten. Wenn das Gerät jedoch extremer Kälte ausgesetzt war (zum Beispiel nachts bei Minustemperaturen im Fahrzeug gelassen wurde) und dann in einen warmen Raum gebracht wird, ist mit einer etwas längeren Anwärmzeit zu rechnen.

3.2 ANSCHLIESSEN DES GERÄTES

Das Kabel der Stromzange mit der BNC-Eingangsbuchse des Verstärkergehäuses verbinden und das Ausgangskabel des Verstärkers an den Vertikaleingang (BNC-Buchse) des Oszilloskops anschliessen; wenn das Oszilloskop eine Eingangsimpedanz von 1 MΩ hat, ist der 50–Ω-Durchgangsabschluss zu verwenden. Danach den Netzspannungsadapter an die Netzspannung anschliessen und zum Schluss das Oszilloskop einschalten. Wenn das Oszilloskop eine elektronische Bereichskennung hat, wird die Abschwächer-Empfindlichkeit automatisch auf 20 mV/div eingestellt und die Eingangsimpedanz auf 50 Ω (nur bei Oszilloskopen mit eingebautem 50–Ω-Eingang).

Falls erforderlich, kann die mitgelieferte Erdungsleitung verwendet werden, um das Einschwingen des Signals zu minimieren. Dieses Kabel muss **zuerst** mit dem Erdanschluss oben an der Stromzange verbunden werden und dann mit dem nächstgelegenen Erdungspunkt des zu messenden Systems.

3.3 RICHTUNG DES STROMFLUSSES

Ein Strom, der in der Richtung des auf der Stromzange abgebildeten Pfeils fliesst, bewirkt eine Ablenkung des Elektronenstrahls nach oben (Stromflussrichtung von + nach -). Dies gilt natürlich nur, wenn die Signalpolarität am Oszilloskop nicht invertiert worden ist (mit dem Einsteller NORM/INVERT).

3.4 BELASTUNG DER ZU TESTENDEN SCHALTUNG

Wenn möglich, ist die Stromzange an dem Leiter mit niedrigem oder Erdpotential anzuklemmen. Auf diese Weise werden die Belastung von kritischen Schaltungen und damit auch das Rauschen und andere Störungen auf ein Minimum reduziert.

3.5 STROMZANGENSCHIEBER

Der Schieber wird benutzt, um die Stromzange zu öffnen und um den zu testenden Leiter zu schliessen. Dieser Leiter wirkt dann als Primärwicklung des Stromtransformators.

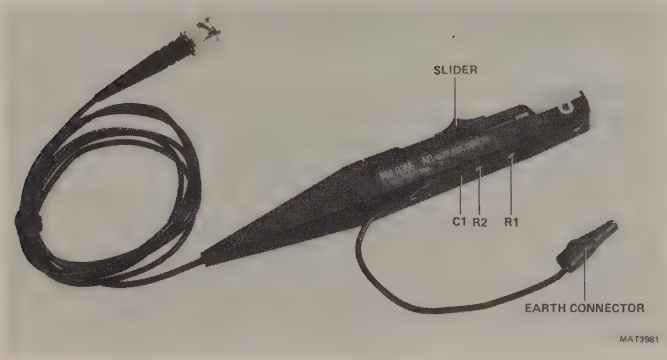

Abbildung 3.1 Stromzange

Es ist darauf zu achten, dass der Schieber während der Messungen ganz nach vorne geschoben wird, so dass die Markierung "ON" zu sehen ist. Hierdurch wird maximaler Kontakt zwischen dem beweglichen und dem unbeweglichen Teil des Transformatorkerns gewährleistet. Wenn der Schieber nicht ganz nach vorne geschoben wird, kann es zu grossen NF-Fehlern kommen.
Als zusätzlicher Schutz der zu testenden Schaltung wird die Abschirmung um den Transformatorkern erst dann geerdet, wenn der Schieber ganz nach vorne geschoben ist ("ON"). Hierdurch werden unbeabsichtigte Erdschlüsse beim Anklemmen der Stromzange vermieden.

3.6 STÖRUNGEN

Die Stromzange sollte nicht für Messungen an einem Leiter verwendet werden, der zu einer Stromschleife mit grosser Fläche gehört, da diese Stromschleife Störungen auffängt, die dann zusammen mit dem Signal dargestellt würden. Wenn die Messung in einer solchen Stromschleife unumgänglich ist, kann die Grösse der mitgemessenen Störungen in Erfahrung gebracht werden, indem die Stromzange an dem Leiter gelassen und die zu testende Schaltung ausgeschaltet wird. Das dann angezeigte Signal stellt die aufgefangene Störung dar. Diese Störung lässt sich aber auch mit einer Differenzmessung ermitteln: Zu diesem Zweck werden Hin- und Rückleitung gleichzeitig durch die Stromzange geführt.

3.7 HOHE STRÖME

Wenn hohe Ströme gemessen werden, darf die Stromzange niemals vom Verstärkergehäuse oder dem Durchgangsabschluss abgeklemmt werden, solange sie an den zu testenden Leiter geklemmt ist. Wenn das Stromzangen-Kabel nicht richtig abgeschlossen ist, entsteht in der Sekundärwicklung eine sehr hohe Spannung, durch die der Stromtransformator beschädigt werden kann.

3.8 VERWENDUNG DER STROMZANGE OHNE VERSTÄRKER

Die Stromzange kann auch ohne Verstärker an ein Oszilloskop mit einer Eingangsimpedanz von 50 Ω oder - bei grösserer Impedanz - über den 50–Ω-Durchgangsabschluss angeschlossen werden. Zu beachten ist hierbei, dass das Transformationsverhältnis für die Stromzange alleine 99:1 beträgt, während es sich bei Benutzung der Stromzange mit Verstärker auf 100:1 beläuft. Das bedeutet, dass bei Verwendung der Stromzange alleine das Ausgangssignal nicht 0,5 V/A beträgt, sondern 0,505 V/A. Der Gesamtablenkkoeffizient kann in diesem Fall durch die Multiplikation von $^{99}/_{50}$ A/V mit dem Ablenkkoeffizienten des Oszilloskops ermittelt werden.

Beispiel: **Das Oszilloskop ist auf 20 mV/div eingestellt.**
Der Gesamtablenkkoeffizient beträgt dann:
$^{99}/_{50}$ A/V x 20 mV/div = 39,6 mA/div

Falls gewünscht, kann die Verstärkung des Oszilloskops so geändert werden, dass sich ein Verhältnis von 100:1 ergibt. Zu diesem Zweck die Stromzange mit dem CAL-Eingang des Oszilloskops verbinden und die Gesamtverstärkung des Oszilloskops so einstellen, dass die gewünschte Ablenkhöhe erreicht wird.

3.9 VERWENDUNG DER STROMZANGE MIT DEM VERSTÄRKER

Für die Verwendung der Stromzange mit dem Verstärker sind die Gesamtablenkkoeffizienten an den Tasten auf der Vorderseite des Verstärkers angegeben. Es steht also ein Strombereich von 1 mA/div bis 1 A/div zur Verfügung. Hierbei ist zu beachten, dass diese Koeffizienten nur dann gelten, wenn das Oszilloskop auf eine Empfindlichkeit von 20 mV/div eingestellt ist.

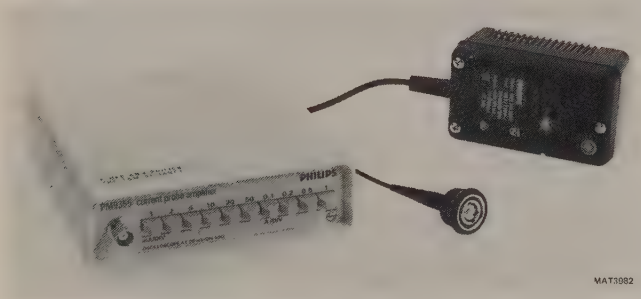

Abbildung 3.2 Verstärkergehäuse

3.10 EINGEFÜGTE IMPEDANZ

Wenn die Stromzange an einen Leiter geklemmt wird, wird damit eine Impedanz in den Strompfad eingefügt. Das entsprechende Ersatzschaltbild ist in Abbildung 3.3 dargestellt.
Im flachen Teil der Frequenzkennlinie beträgt die eingefügte Impedanz etwa 50 Ω/99^2 Windungen ≈ 5 mΩ.

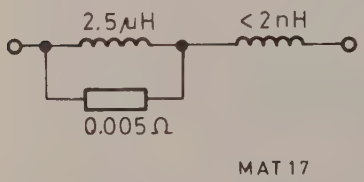

Abbildung 3.3 Ersatzschaltbild für die eingefügte Impedanz

3.11 PRAKTISCHE HINWEISE ZUR DURCHFÜHRUNG EINER MESSUNG

3.11.1 Erhöhen der Empfindlichkeit

Die Stromempfindlichkeit kann durch Erhöhen der Primärwindungszahl vergrössert werden. Wird der Leiter doppelt durch den Stromwandler geführt, wird der Sekundärstrom verdoppelt, da sich das Stromverhältnis im Transformator umgekehrt proportional zum Windungsverhältnis verhält.
Dabei ist jedoch zu beachten, dass sich auch die eingefügte Impedanz in Reihe mit der zu messenden Schaltung mit dem Quadrat der Primärwindungszahl erhöht.
Die Empfindlichkeit kann auch gesteigert werden, indem der Ablenkkoeffizient des Oszilloskops herabgesetzt wird. Wenn der Ablenkkoeffizient auf 10 mV/div eingestellt wird, wird die Empfindlichkeit der Strommessung um Faktor 2 erhöht. Ein Nachteil dabei ist, dass auch das Rauschen verstärkt wird.

3.11.2 Verringern der Empfindlichkeit

Für die Messung von Strömen, die mehr als die spezifizierten 12 A S-S betragen, kann die Stromempfindlichkeit der Stromzange folgendermassen reduziert werden:

Den Leiter auftrennen, in dem der hohe Strom gemessen werden soll. Zwei, drei oder mehr etwa 10 cm lange Stücke vom gleichen Draht an beiden Enden zusammenlöten, so dass man einen Leiter mit zwei, drei oder mehr parallelen Drähten erhält. Dieser Leiter wird nun in den Stromkreis eingefügt. Die Stromzange an EINEM der Drähte festklemmen. Besteht die Brücke aus zwei Drähten, ist der Strom durch die Stromzange nur halb so gross wie der Strom durch den Leiter, besteht die Brücke aus drei Drähten, so beträgt der Strom durch die Stromzange nur ein drittel usw.

F

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NOTE POUR LE COLISAGE

Le carton d'expédition doit contenir les éléments suivants:
- 1 Sonde pour courant CA pour PM9355
- 1 Amplificateur PM9355 pour sonde sur courant doté d'un adaptateur pour secteur
- 1 Connexion de 50 Ω pour PM9585
- 1 Câble de mise à la masse
- 1 Boîtier de transport avec pièce rapportée
- 1 Manuel d'utilisation

INSPECTION INITIALE

Vérifiez le contenu du colis expédié pour vous assurer qu'il est complet et notez éventuellement les dégâts qui se seraient produits au cours du transport. Si le contenu est incomplet ou endommagé, une plainte devra être immédiatement adressée au transporteur, tandis que l'organisation de vente ou de service PHILIPS/FLUKE sera notiifée en vue de faciliter la réparation ou le remplacement de l'appareil.

Merci d'avoir choisi cette sonde pour courant CA et l'amplificateur Philips PM9355. Ils ont été conaus et fabriqués en tenant compte des standards de qualité les plus élevés pour pouvoir vous procurer des années de mesures précises et sans problèmes.

Vos suggestions sur l'amélioration de ce produit seront les bienvenues si vous contactez votre réseau local Fluke/Philips.

INTRODUCTION

La sonde pour courant CA PM9355 est un appareil de mesure en courant alternatif, composée d'un transformateur d'intensité à pince et d'un amplificateur à compensation de fréquence. Ce dernier comporte les commutateurs du champ de mesure.

La sonde de courant doit être utilisée avec des oscilloscopes ayant une impédance d'entrée de 50 Ω. Les oscilloscopes ayant une impédance de 1 MΩ peuvent également être utilisés, mais uniquement avec la connexion fournie de 50 Ω.

La sortie BNC de l'amplificateur est munie d'un indicateur de gamme, qui aligne l'oscilloscope sur un réglage d'atténuation de 20 mV/div.

Les circuits de la sonde fonctionnent sur l'alimentation secteur (courant alternatif).

1 SECURITE DES UTILISATEURS

ATTENTION: Lire attentivement cette page avant d'installer et d'utiliser l'appareil.

1.1 INTRODUCTION

L'appareil décrit dans ce manuel a été conau pour être utilisé par du personnel correctement formé. Les réglages, la maintenance et la réparation de cet équipement ne doivent être réalisés que par du personnel qualifié.

1.2 PRECAUTIONS DE SECURITE

Il est très important pour utiliser correctement et en toute sécurité cet appareil que le personnel d'exploitation et le personnel d'entretien suivent les procédures de sécurité communément acceptées en plus des précautions spécifiées dans ce manuel. Des avertissements d'attention et de danger sont donnés, le cas échéant, dans ce manuel. Les avertissements et/ou les symboles de danger et d'attention sont placés si nécessaire sur l'appareil.

1.3 AVERTISSEMENTS D'ATTENTION ET DE DANGER

ATTENTION: Ce terme est utilisé pour indiquer les procédures correctes d'exploitation ou de maintenance de manière à éviter d'endommager ou de détruire l'équipement ou un autre matériel.

DANGER: Ce terme attire l'attention sur un danger potentiel exigeant des procédures ou des pratiques correctes de manière à éviter de blesser le personnel.

1.4 SYMBOLES

Lire les instructions de manipulation.

Borne de terre de protection (noire)

1.5 SYSTEME DE PROTECTION ENDOMMAGE

Chaque fois qu'il est probable qu'un dispositif de sécurité a été endommagé, l'appareil doit être neutralisé et protégé contre toute manipulation involontaire. Le problème doit être rapporté à des techniciens qualifiés. La protection de sécurité est susceptible d'être atteinte si, par exemple, l'appareil ne produit pas les performances qu'il devrait, ou s'il montre des traces évidentes de dommages.

2 INSTRUCTIONS D'INSTALLATION

ATTENTION: Il est fortement conseillé de lire soigneusement ce chapitre avant d'installer la sonde de courant CA et l'amplificateur.

2.1 INSTALLATION

Avant de brancher l'amplificateur à l'oscilloscope, assurez-vous que les règles de sécurité mentionnées ci-dessous sont scrupuleusement respectées.

2.2 REGLEMENTS DE SECURITE (CONFORMES A LA CEI 348)

2.2.1 Mise à la terre

Avant de brancher l'appareil au secteur, vérifiez que le boîtier, les commandes et les connecteurs, etc. n'ont pas été endommagés pendant le transport. Si vous détectez des défauts, ne connectez pas l'appareil au secteur.

L'appareil doit être débranché de toute source de tension avant que ne soit exécuté tout travail de maintenance ou de réparation.
S'il est indispendable de retirer le couvercle pour procéder aux réglages ou à la maintenance de l'appareil, cette opération ne doit être effectuée que par une personne qualifiée, consciente des dangers existants. Dans des conditions normales de fonctionnement, la double isolation de l'alimentation en courant ne nécessite pas de mise à la terre de sécurité.

DANGER: **Il est important de garder à l'esprit que dans toutes les mesures, la masse du châssis de la sonde de courant CA et de l'amplificateur est augmentée jusqu'à atteindre le même potentiel que celui de la connexion de la sonde de mise à la terre. Ni le conducteur de la sonde ni la masse du châssis ne doivent être connectés à des potentiels sous tension.**

MISE A LA TERRE: **Si le transformateur de la sonde de courant CA est serré autour d'un conducteur dont le potentiel est supérieur à 30 V (valeur efficace) ou 42,4 V (crête cc et ca), la vis de terre, située à l'arrière de l'amplificateur, doit être correctement mise à la terre.**

2.2.2 Réglage de la tension secteur

L'adapteur pour secteur permet de sélectionner la tension secteur, et donc de travailler sur des tensions secteur de 110 V ou de 220 V.

Avant de brancher l'appareil sur le secteur, assurez-vous qu'il est réglé sur la tension secteur locale. A la livraison, il est réglé sur 220 V. Si l'appareil doit être utilisé sur une alimentation de 110 V, il faudra sélectionner la tension appropriée en tournant le commutateur situé à l'arrière de l'adaptateur pour secteur à l'aide d'un tournevis. La tension sélectionnée est indiquée à la fenêtre de l'adaptateur pour secteur.

DANGER: L'appareil doit être débranché de toute source de tension lorsque l'adaptateur pour secteur doit être adapté à une tension secteur différente.

3 INSTRUCTIONS D'UTILISATION

3.1 MISE EN SERVICE DE L'APPAREIL

Avant de brancher l'appareil sur le secteur, il convient de lire soigneusement les instructions figurant à la section 2.1 (Installation).
Lorsque l'adaptateur pour secteur est connecté au secteur, le PM9355 est immédiatement prêt à être utilisé. Normalement, après un temps de démarrage de 15 minutes, l'appareil est prêt à fonctionner. Toutefois, s'il se trouvait dans un endroit extrêmement froid (par exemple, s'il a été laissé dans la voiture pendant la nuit à des températures très froides) et amené ensuite dans un local chaud, il faudra lui consentir un temps de démarrage suffisant.

3.2 CONNEXIONS INITIALES

Branchez le câble de la sonde de courant CA à la prise d'entrée BNC du boîtier de l'amplificateur. Connectez le câble de sortie de l'amplificateur à l'entrée verticale BNC de l'oscilloscope; si nécessaire, utilisez la connexion 50 Ω si la sortie de l'oscilloscope est de 1 mΩ. Branchez ensuite l'adaptateur pour secteur au secteur. Mettez enfin l'oscilloscope sous tension. Lorsque l'oscilloscope est muni d'un indicateur de gamme, la sensibilité de l'atténuateur est automatiquement réglée sur 20 mV/div et l'impédance d'entrée est réglée sur 50 Ω (ne fonctionne que sur des oscilloscopes avec dispositif d'entrée de 50 Ω.

Si nécessaire, le câble de la mise à la masse fourni avec le matériel peut être utilisé pour minimiser la surmodulation d'un signal. Ce câble doit **d'abord** être branché à la prise de terre située sur le dessus de la sonde de courant et être ensuite connecté au point de mise à la terre le plus proche du circuit devant être mesuré.

3.3 DIRECTION DU FLUX DE COURANT

Le courant classique (qui va du + au -) circulant dans la direction de la flèche sur la sonde provoquera une déviation vers le haut sur l'écran de l'oscilloscope. Bien entendu, cela se produit uniquement si la polarité du signal n'a pas été inversée par la commande NORM/INVERT de l'oscilloscope.

3.4 CHARGEMENT DU CIRCUIT PENDANT L'ESSAI

Lorsque cela est possible, fixez la sonde de courant CA autour de la queue du composant à faible potentiel ou autour de l'extrémité de la masse de celui-ci. De cette manière, la charge de circuit critique et l'affichage de bruit et d'interférence seront minimisés.

3.5 CURSEUR DE SONDE

Le curseur de sonde est utilisé pour ouvrir le noyau du transformateur à pince à l'extrémité de la sonde et pour le fermer autour du conducteur pendant le test. Ce conducteur fait fonction d'inducteur pour le transformateur de courant.

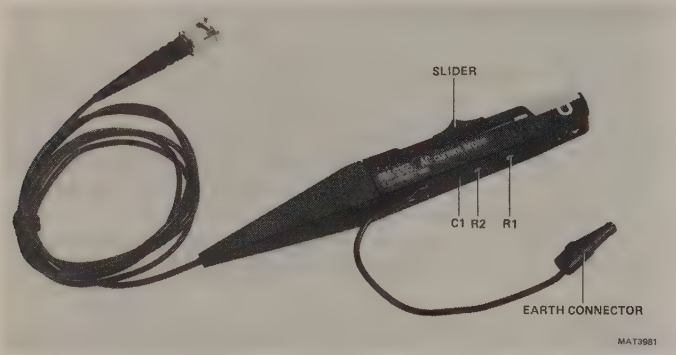

Figure 3.1 Sonde de courant CA

Assurez-vous que pendant les mesures, le curseur se trouve bien en avant, le mot ON étant visible, étant donné que cela garantit un contact maximum entre la partie mobile et fixe du noyau du transformateur. Si le curseur n'a pas été poussé jusqu'au bout, des erreurs importantes en basse fréquence peuvent se produire. Pour protéger davantage le circuit pendant le test, la protection autour du noyau du transformateur n'est connectée à la masse que lorsque le curseur est dans sa position la plus avancée (ON). De cette manière, des courts-circuits accidentels sont évités lorsque la sonde est serrée autour du conducteur pendant le test.

3.6 INTERFERENCE

Ne serrez pas le transformateur de sonde de courant CA autour du conducteur qui est partie intégrante d'une large boucle de courant. Celle-ci capte l'interférence qui sera affichée avec le signal. Si la mesure doit absolument s'effectuer dans une grande boucle, il est possible d'obtenir l'ordre de grandeur de l'interférence en laissant la sonde autour du conducteur et en mettant hors tension le courant d'essai. Le signal affiché correspond à l'interférence captée. Il est également possible de déterminer l'interférence par une mesure différentielle. Serrez à cette extrémité le transformateur de la sonde de courant CA simultanément autour du conducteur avant et de retour.

3.7 HAUTES INTENSITES

Si des hautes intensités sont mesurées, ne déconnectez jamais le transformateur de sonde de courant CA du boîtier de l'amplificateur ou de sa connexion lorsqu'il est encore serré autour du conducteur soumis à l'essai. Lorsque le câble n'est pas connecté de cette manière, une très haute tension, susceptible d'endommager le transformateur d'intensité, est produite dans l'enroulement secondaire.

3.8 UTILISATION DE LA SONDE DE COURANT CA UNIQUEMENT

La sonde de courant CA peut être utilisée séparément sur un oscilloscope avec impédance d'entrée de 50 Ω ou par l'intermédiaire de la connexion de 50 Ω. Il convient toutefois de garder présent à l'esprit que le rapport de transformation est de 99 : 1 pour la sonde uniquement et de 100 : 1 lorsque la sonde est utilisée avec l'amplificateur. Cela implique que pour la sonde uniquement, le signal de sortie n'est pas de 0,5 V/A, mais de 0.505 V/A. Le coefficient de déviation total peut s'obtenir dans ce cas en multipliant $^{99}/_{50}$ A/V par le coefficient de déviation de l'oscilloscope.

Exemple: **Réglage de l'oscilloscope à 20 mV/div.**
Le coefficient de déviation total est de:
$^{99}/_{50}$ A/V x 20 mV/div = 39,6 mA/div

Le cas échéant, le gain de l'oscilloscope peut être modifié pour constituer un rapport de 100 : 1. Serrez à cette extrémité la sonde autour de la boucle de courant CAL de l'oscilloscope et réglez à nouveau le gain total de l'oscilloscope afin d'obtenir la hauteur de trace désirée.

3.9 UTILISATION DE LA SONDE AVEC L'AMPLIFICATEUR

Lorsque la sonde de courant CA est utilisée avec l'amplificateur fourni, le coefficient de déviation total est mentionné sur la plaquette indicatrice du bouton-poussoir située sur la face avant de l'amplificateur. On obtient une gamme de courant allant de 1 mA/div jusqu'à 1 A/div. Il est important de se souvenir que ces coefficients ne sont valables que lorsque l'oscilloscope d'essai a une sensibilité de 20 mV/div.

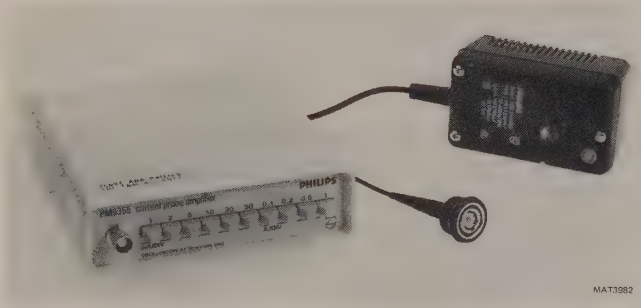

Figure 3.2 Boîtier de l'amplificateur

3.10 IMPEDANCE D'INSERTION

L'impédance d'insertion de la sonde de courant correspond au circuit équivalent inséré dans le trajet du courant lorsque le transformateur de la sonde de courant CA est serré autour du conducteur soumis au test. Le circuit équivalent est indiqué à la Figure 3.3.
Dans la partie plate de la caractéristique de la fréquence, l'impédance d'insertion est d'approximativement 50 Ω/99^2 tours ≈ 5 mΩ.

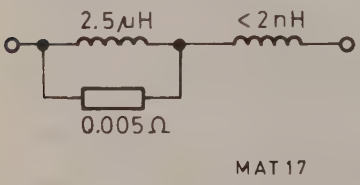

Figure 3.3 Circuit équivalent constituant l'impédance d'insertion

3.11 CONSEILS DE MESURE

3.11.1 Augmentation de la sensibilité

La sensibilité du courant peut être augmentée en accroissant le nombre de tours primaires. En faisant passer deux fois le conducteur soumis au contrôle à travers le transformateur de courant, le courant secondaire est augmenté d'un facteur de deux, étant donné que le taux de courant dans un transformateur est inversément proportionnel au taux de tours.
Toutefois, il est important de savoir que l'impédance d'insertion qui vient en série avec le circuit devant être mesuré, varie selon le carré des tours primaires.
Il est également possible d'augmenter la sensibilité en réglant le coefficient de déviation de l'oscilloscope sur une valeur inférieure. Si le coefficient est réglé sur 10 mV/div, la sensibilité pour les courants est augmentée d'un facteur de deux. Cette opération comporte cependant un désavantage, à savoir l'affichage de plus de bruit.

3.11.2 Diminution de la sensibilité

Afin de mesurer des courants plus élevés que le courant maximum spécifié crête-à-crête de 12 A, la sensibilité du courant de la sonde peut être diminuée de la façon suivante:

Interrompez le conducteur dont le courant élevé doit être mesuré. Prenez deux, trois ou davantage de morceaux de fils identiques, coupez-les sur environ 10 cm et soudez-les aux deux extrémités, de manière à obtenir un conducteur de deux, trois ou davantage de fils en parallèles. Fermez le trajet du courant en soudant l'interruption du trajet du courant à l'aide de l'assemblage des fils. Serrez le transformateur de sonde de courant CA autour de l'UN des fils de l'assemblage. Si cet assemblage comporte deux fils, le courant passant dans la sonde sera égal à la moitié de celui qui passe par le conducteur, ou égal à un tiers du courant si l'assemblage comporte trois fils, etc.

S

SERVICE MANUAL

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4 CHARACTERISTICS

PERFORMANCE CHARACTERISTICS

Properties expressed in numerical values with stated tolerance are quaranteed by PHILIPS. Specified non-tolorance numerical values indicate those that could be nominally expected from the mean of a range of identical instruments.
Unless otherwise stated, the specifications listed are valid for the type PM9355 (current probe with amplifier) only, i.e. excluding the effects of the test oscilloscope.
This specification is valid after the instrument has warmed up to 15 minutes (reference temperature 23 °C).
For definition of terms, reference is made to IEC Publication 351-1.

SAFETY CHARACTERISTICS

The instrument has been designed and tested in accordance with Safety Class II requirements of IEC Publication 348, Safety requirements for Electronic Measuring Apparatus and has been supplied in a safe condition.

INITIAL CHARACTERISTICS

Dimensions

	L	W	H	
Probe body	173	18	28 mm	Maximum dimensions
Probe cable	1500		mm	
Supply cable	2000		mm	Maximum dimensions
Amplifier	155	142	42 mm	
Output cable	500		mm	Maximum dimensions
Carrying case	260	340	62 mm	

Characteristics	Specification	Additional information

4.1 ELECTRICAL

Output	50 Ω	Oscilloscope to 20 mV/div and d.c.
Output range	+or -6 div	input coupling
Output offset	+or -$^1/_4$ div	Oscilloscope to 20 mV/div and d.c. input coupling
Offset drift	negligible	Oscilloscope to 20 mV/div and d.c. input coupling
Deflection coefficient	1 mA/div ... 1 A/div in ten ranges (1-2-5 sequence)	Oscilloscope to 20 mV/div and d.c. input coupling
Error limit	+or -3%	
Bandwidth	≤ 2 Hz to ≥ 70 MHz (-3 dB)	At 5 mA/div to 1 A/div
	≤12Hz to ≥45MHz (-3 dB)	At 1 mA/div and 2 mA/div
Rise time (10%-90%)	5 ns	At 5 mA/div to 1 A/div measured at a trace height of +or- 4 div starting from the centre of the screen
	8 ns	At 1 mA/div and 2 mA/div measured at a trace height of +or- 4 div starting from the centre of the screen
Aberrations	≤ +or- 5% during the first 50 ns of step; ≤ +or- 1% thereafter.	At 1 mA/div to 20 mA/div
	≤ +or- 6% during the first 50 ns of step; ≤ +or- 1% thereafter.	At 50 mA/div to 1 A/div

Characteristics	Specification	Additional information
Tilt	≤3% during the first 400 s of step	
Maximum current	12 $A_{(p-p)}$	f ≥300 Hz; for l.f. signals see Figure 4.1.

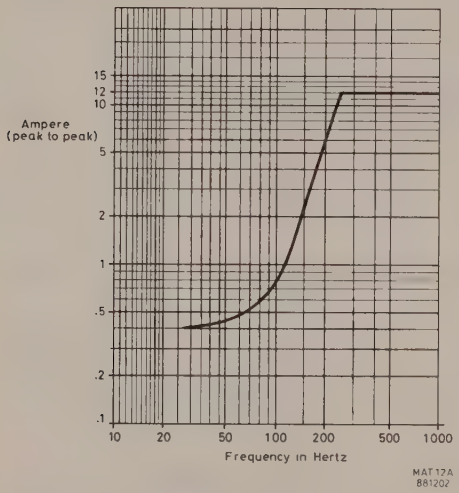

Figure 4.1 Derating of max. current for l.f. signals

Maximum voltage	600 V(d.c. + a.c. peak)	When probe is closed
Noise	≤150 μA referred to input, or 0,02 div whichever is larger	Tangentially measured
Capacitive load	0,5 to 2 pF	Depends on diameter of conductor

Characteristics	Specification	Additional information
Capacitive cross-talk	See Figure 4.2.	

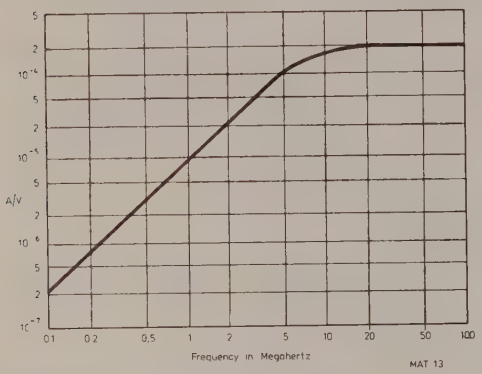

Figure 4.2 Capacitive cross-talk

Delay time	12 ns ±1 ns	Current transformer without amplifier
	25 ns ±2 ns	Current transformer together with amplifier
Mains adaptor		Double insulated, Safety class II of IEC 348
Line voltages	220 V + 20% / -10%	
	100 V + 30% / -10%	
Line frequency	50...400 Hz 10%	
Power consumption	10 VA max.	

4.2 ENVIRONMENTAL

The environmental data mentioned in this manual are based on the results of the manufacturer's checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS/FLUKE-organisation in your country, or by PHILIPS, INDUSTRIAL AND ELECTRO-ACOUSTIC SYSTEMS DIVISION, EINDHOVEN, THE NETHERLANDS.

Ambient temperature	+5 °C...+40 °C	Rated range of use
	-10 °C...+55 °C	Limit range of operation
	-40 °C...+70 °C	Storage and transport
Humidity	In accordance with IEC68Db	Non-operating
Altitude	to 5000m	Operating within specs
	to 15000m	Storage
Vibration	In accordance with IEC68Fc	Operating
Shock	In accordance with IEC68Eb	Non-operating

5 CIRCUIT DESCRIPTION

5.1 CLIP-ON CURRENT TRANSFORMER

The current to be measured is inductively picked up by the primary of transformer A102. The current is transformed down by a factor of 99. The correction networks R1/L127, R2/L126 and C1/R126 allow setting of optimum pulse response and rise time. Network R127/L128 and transformer L129 compensate for losses in the cable between current transformer and amplifier.

5.2 AMPLIFIER

The signal on output BNC socket X2 of the current probe, is applied to input socket X1 of the amplifier. Networks R201/C201 and R213/C202 in the input stage act as a termination for the cable between the current transformer and the amplifier, whereas networks R206/L201 and R207/L202 compensate for losses in this cable.

To achieve the different measuring ranges in 1-2-5 sequence, an input attenuator has been used in combination with different outputs of emitter follower V207 and gain-setting networks in the output stage.
Reed relays switch-in the various combinations as dictated by the pushbutton switches on the front panel.

The input attenuator comprises two low-ohmic voltage divider sections which are bypassed in certain measuring ranges. The section with resistor R212 gives an attenuation of 10 times and the one with R209 of 100 times. Trimmer capacitor C203 and potentiometer R211 make the sections independent of frequency and potentiometer R202 allows adjustment of the 20 mA/div range and onwards.

From the input attenuator, the signal is fed to the first amplifier stage which consists of transistors V203 and V204. This stage may be considered as an operational amplifier with a gain of approximately 3 times. This gain is determined by the ratio between feedback resistor R219 and resitor R207 in the input attenuator when the latter is in the "straight-through" position (1x).

The input resistance of the operational amplifier D201-A is low: the input is a virtual earth point. This is true because the input resistance is formed by the feedback resistance of R219 divided by the open-loop gain of transistor V203. As this gain is very high, the input resistance is only a few ohms. The input resistance must be equal in all positions of the input attenuator. In the 10x and 100x attenuated positions, the input resistance equals R202/R203/R204 = 5 Ω. The input resistance in the "straght-through" position equals the input resistance of transistor V203. The resistance is adjusted to 5 Ω by varying the open-loop gain of transistor V203 with the aid of preset potentiometer R222.

The three amplified signal on the emitter of V204 is further amplified by this transistor. The signal at its collector is 20x the signal at the attenuator input.

The -3dB turn-over frequency of the clip-on current transformer at the lower side of the frequency-response curve is determined by the self-inductance and the internal resistance of the current transformer, and by the input resistance of the amplifier. This frequency is approximately 120 Hz. The specified lower frequency limit of the current transformer/amplifier combination, however, is 12 Hz. In order to obtain this lower frequency limit, the gain of transistor V204 is increased for frequencies below 120 Hz. The gain increase is proportional to the roll-off below 120 Hz of the current probe's frequency response curve.

The gain increase is obtained by splitting the collector load of transistor C204 into a higher frequency part and a low frequency part. At higher frequencies, the collector load is formed by resistor R231, the other resistor R229 being bypassed by capacitor C208 and the transformed C218. At low frequencies, the load is chiefly determined by resistor R229, increasing the gain up to approximately 200 at 12 Hz. In this way, a frequency response for the combination with a lower -3dB point of 12 Hz is realized.

For a flat frequency response curve it is, of course, essential that the turn-over frequency of the current probe and the frequency at which the gain of transistor V204 starts increasing are the same.
These frequencies are equalized by varying the value of the bypass capacitor in parallel with resistor R229.

The value of the bypass capacitor is varied with the aid of operational amplifier D210-B. The gain of this amplifier is determined by resistors R252 and R249: gain A = ^{R252} / $_{R249}$. This means that the voltage across C218 is (A+1) times the voltage at junction R229-R231. The circuit with operational amplifier D201-B allows a capacitance variation between 1µF and 11µF. As the capacitance of this circuit is in parallel with resistor R229, potentiometer R252 allows the turn-over frequency of the amplifier to be aligned with the turn-over frequency of the current probe.

The signal on the collector of transistor V204 is applied to emitter-follower V207. The emitter signal of V207 is available at three different levels. These levels are selected together with the input attenuator sections with the aid of the reed relays operated by the pushbuttons S1A...J.
The d.c. level at the emitter of transistor V207 is compared to earth level (point 4) in D201. The difference is fed back to the emitter of V207, via transistor V206 and V204. The phase of the feedback signal is such that any d.c. level on the emitter of V207 is compensated for: the emitter potential is maintained at 0 V.
For a.c. signals, the feedback system is short-circuited by capacitor C216.

Via emitter-follower V208, the emitter signal of transistor V207 is applied to the second amplifier stage with transistor V212. The gain of this stage is 5x in positions 1 mA/div and 2 mA/div and 1x in the other positions. This difference in gain is accomplished by varying the emitter resistance of transitor V212 with the aid of relay K209. The x1 gain is adjusted by means of preset potentiometer R262 and the x5 gain by R264. The other networks in the emitter of V212 enable the square-wave response to be optimized.

Transistor V209 acts as a voltage source for the amplifier stage. Transistor V213 is the output stage with a gain of unity when the output terminates in 50 Ω. Operational amplifier D201-C and V214 are part of a feedback system similar to the one with D201-A and V206. With the aid of the feedback system the d.c. output level is maintained at 0 V.

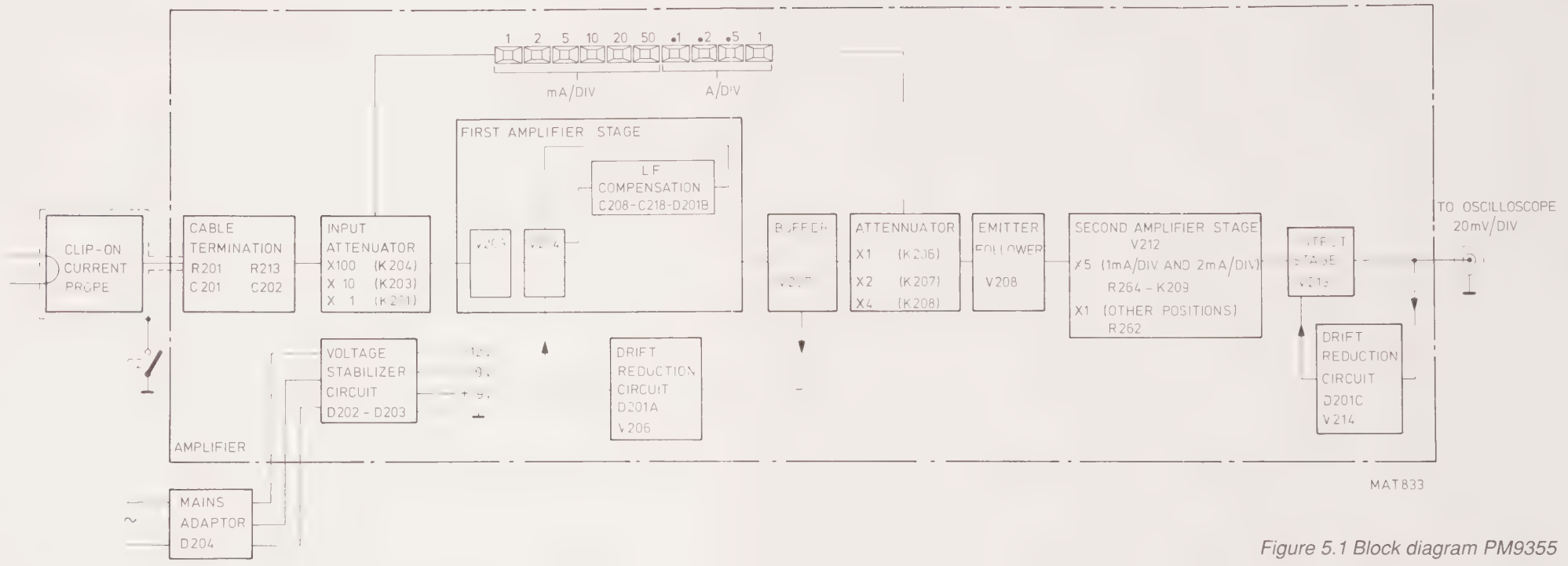

Figure 5.1 Block diagram PM9355

6 DISMANTLING

6.1 GENERAL INFORMATION

This section provides the dismantling procedures required for the removal of components during repair operations. When a circuit board is removed from the instrument, it should be adequately protected against damage, and all normal precautions regarding the use of tools must be observed.
During dismantling procedures, a careful note must be made of all disconnected leads to ensure that they may be reconnected to their correct positions during assembly.

6.2 DISMANTLING THE AMPLIFIER BOX

- Remove the two screws at the rear of the cabinet.

- Slide the cabinet off the amplifier; all components on the printed-wiring board are then accessible.

6.3 ACCESS TO PARTS FOR ADJUSTING PROCEDURE

All adjusting elements of the AC current probe are accessible via holes in the probe's cover.
The adjusting elements in the amplifier box are accessible after removing the cabinet of the box.

NOTE: For adjustment always use an insulated adjustment tool.

7 CHECKING AND ADJUSTING

7.1 GENERAL INFORMATION

The following information provides the complete checking and adjusting procedure for the current probe. As various control functions are interdependent, a certain order of adjustment is often necessary.
The procedure is, therefore, presented in a sequence which is best suited to this order, cross-reference being made to any circuit which may affect a particular adjustment.

Before any check or adjustment, the instrument must attain its normal operating temperature.

Where possible, instrument performance is checked before an adjustment is made.

- Warming-up time under average conditions is 15 minutes.
- All limits and tolerances given in this section are calibration guides and should not be interpreted as instrument specifications unless they are also published in Section 4 "Characteristics".
- Tolerances given are for the instrument under test and do not include test equipment error.

WARNING: The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts, and also accessible terminals may be live. The instrument shall be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the instrument will be opened. If afterwards any adjustment, maintenance or repair of the opened instrument under voltage is inevitable, it shall be carried out only by qualified personnal who is aware of the hazard involved. Bear in mind that capacitors inside the instrument may still be charged even if the instrument has been separated from all voltage sources.

7.2 RECOMMENDED EQUIPMENT

Type of instrument	Required specification	Example of recommended instrument
Oscilloscope	Bandwidth: 100 MHz	PM3065
Function generator	Freq: 100 Hz...250 kHz Square wave Ampl: 0...15 V_{pp} Rise time <70 ns Duty cycle 50%	PM5134
Constant amplitude sine-wave generator	Freq: 250 kHz... 100 MHz Constant ampl. of 0,3 V_{pp}-1,5 V_{pp}	Tektronix SG 503
Pulse generator	Freq: 100 kHz... 500 kHz Ampl: 1...10 V_{pp} Rise-time 1 ns	Picosecond Pulselabs Model 2500-02
Adapter General Radio to BNC (male)		PM 9064 or Tektronix 017-0064-00
BNC T-piece		PM9607
50 Ω Termination (supplied with the instrument)		PM9585
Calibration fixture		Tektronix 067-0559-00

The current probe is checked and adjusted in the following sequence:
- The AC current probe only (section 7.3)
- The Probe-Amplifier combination (section 7.4)

Note: Always use the current probe with the same 50Ω termination (PM 9585).

7.3 CHECKING AND ADJUSTING PROCEDURE

7.3.1 AC Current probe only

7.3.1.1 Transformation ratio (99:1)

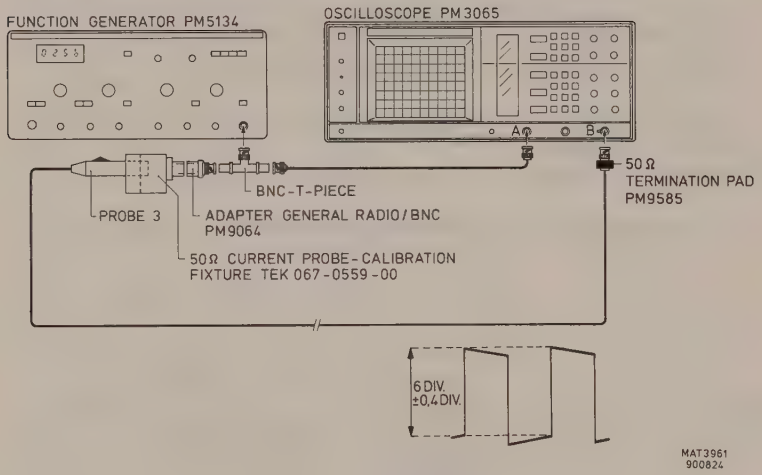

Figure 7.1 LF Measuring set-up for probe only

- Use measuring set-up according to figure 7.1.
- Set the oscilloscope controls to: AMPL/DIV A and B = 0,5 V
  TIME/DIV: 20 µs
- Set the generator to: - square-wave
  - frequency = 10 kHz
  - duty cycle = 50 %
- Set the trace height of channel A of the oscilloscope to 6 divisions (3 Vp- p) by means of the function generator amplitude control.
- Ensure that signal on channel B is according to figure 7.1.

7.3.1.2 LF response

- Use measuring set-up according to figure 7.1.
- Set the oscilloscope controls to: AMPL/DIV B = 20 mV (channel A not used)
  TIME/DIV: 2 µs
- Set the generator to: - sine-wave
  - frequency = 100 kHz
  Set the trace height of channel B of the oscilloscope to 5 divisions (100 mV_{p-p}) by means of the function generator amplitude control.

- Decrease the frequency of the generator until the oscilloscope gives a trace height of 3,5 divisions.
- Ensure that the frequency at this point (-3dB) is ≤450 Hz.

7.3.1.3 HF response

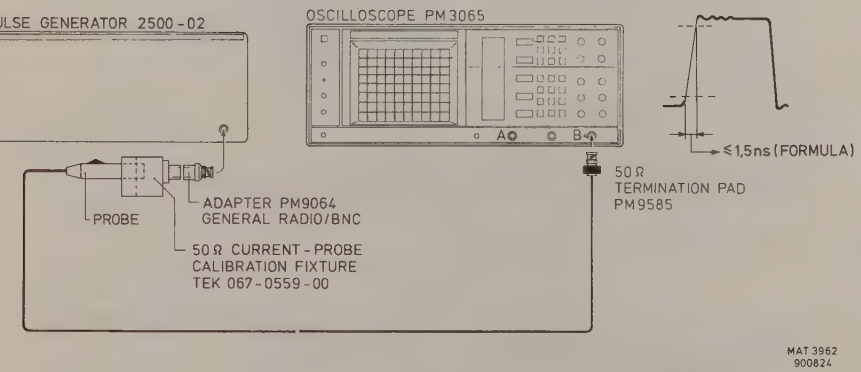

Figure 7.2 HF Measuring set-up for probe only

- Use measuring set-up according to figure 7.2.
- Set the oscilloscope controls to: AMPL/DIV B = 20 mV (channel A not used)
  TIME/DIV: 2 µs
- Set the generator to: - amplitude = 10 V(p-p)
  - frequency = 100 kHz
- Check the square-wave response, the rise-time should not exceed 1,5 ns.

$$tr-probe = \sqrt{(tr-meas)^2 - (tr-scope)^2}$$

tr-scope = 3,5 ns

ADJ: if necessary, adjust potentiometers R1 and R2 and trimmer C1

7.3.2 Probe - Amplifier combination

ATTENTION: Unless otherwise stated, the controls always occupy the same position as in the previous check.

7.3.2.1 Deflection coefficients

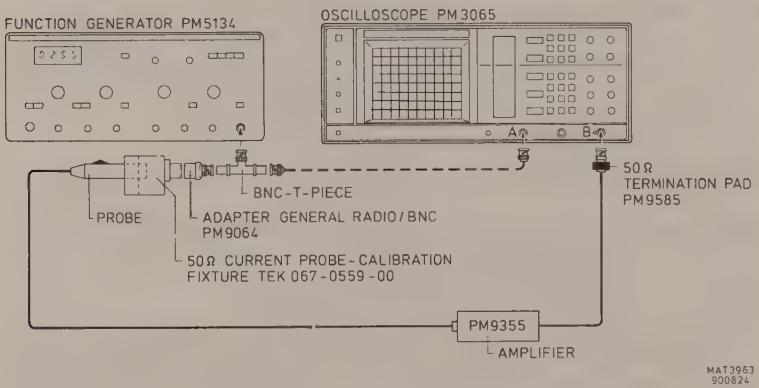

Figure 7.3 LF measuring set-up for combination

- Use measuring set-up according to figure 7.3 (without YA)
- Set the oscilloscope controls to: AMPL/DIV B = 20 mV (channel A not used)
  TIME/DIV: 2 µs
- The probe is not yet connected to the generator.
- Release all amplifier pushbuttons.
- Press GND of channel B of the measuring oscilloscope for a grounded display.
- Adjust the time-base line to the centre of the screen by means of the POSITION potentiometer.
- Press GND of channel B of the measuring oscilloscope another time so that the input coupling is DC.
- Press the 5 mA/DIV pushbutton on the amplifier box.
- Ensure that the time-base line is still in the centre of the oscilloscope screen; tolerance +or- 1/4 division.

- Use measuring set-up according to figure 7.3
- Set the oscilloscope controls to: AMPL/DIV A and B = 20 mV
  TIME/DIV: 2 µs
- Set the generator to: - square-wave
  - amplitude = 30 mA_{p-p} (1,5 V_{p-p} across 50 Ω)
  - frequency = 10 kHz
  - duty-cycle = 50 %
- Set the trace height on channel A on 3 divisions (60 mV_{p-p}) by means of the function generator amplitude control.
- Ensure that the trace height on channel B is 6 divisions.

ADJ: if necessary, adjust potentiometer R262.

- Check also the deflection coefficients 10 mA/DIV and 20 mA/DIV using suitable current values; tolerance +or- 3%.
- Press the 50 mA/DIV pushbutton on the amplifier box.
- Increase the input current to 300 mA_{p-p} (15 V_{p-p} across 50 Ω)
- Ensure that the trace height on channel B is 6 divisions.

ADJ: if necessary, adjust potentiometer R202.

- Press the 1 mA/DIV pushbutton on the amplifier box.
- Decrease the input current to 6 mA_{p-p} (0,3 V_{p-p} across 50 Ω)
- Ensure that the trace height is 6 divisions.

ADJ: if necessary, adjust potentiometer R264.

- Depress the 0,5 A/DIV pushbutton on the amplifier box.
- Increase the input current to 300 mA_{p-p} (15 V_{p-p} across 50 Ω)
- Set the AMPL/DIV of channel B of the measuring oscilloscope to 5 mV/DIV.
- Ensure that the trace height of channel B is 2,4 divisions +or- 3%.

7.3.2.2 LF response

- Use measuring set-up according to figure 7.3
- Set the oscilloscope controls to: AMPL/DIV A and B = 20 mV
  TIME/DIV: 200 µs
- Set the generator to: - square-wave
  - amplitude = 300 mA_{p-p} (15 V_{p-p} across 50 Ω)
  - frequency = 100 Hz
  - duty-cycle = 50 %
- Press the 50 mA/DIV pushbutton on the amplifier box.
- Ensure that the top of the displayed pulse is straight (see figure 7.4).

ADJ: if necessary, adjust potentiometer R252.

Figure 7.4 LF response

- Decrease the input current to 30 mA_{p-p}.
- Press the 5 mA/DIV pushbutton on the amplifier box.
- Ensure that the top of the displayed pulse is straight.

ADJ: if necessary, adjust potentiometer R222

- Set the generator to:- sine-wave
  - amplitude = 30 mA_{p-p} (1,5 V_{p-p} across 50 Ω)
  - frequency = 1 kHz
- Ensure that the trace height of channel A of the measuring oscilloscope is 6 divisions.
- Decrease the frequency of the generator until the trace height is 4,2 divisions.
- Ensure that the frequency of the generator is maximum 12 Hz.

7.3.2.3 HF response

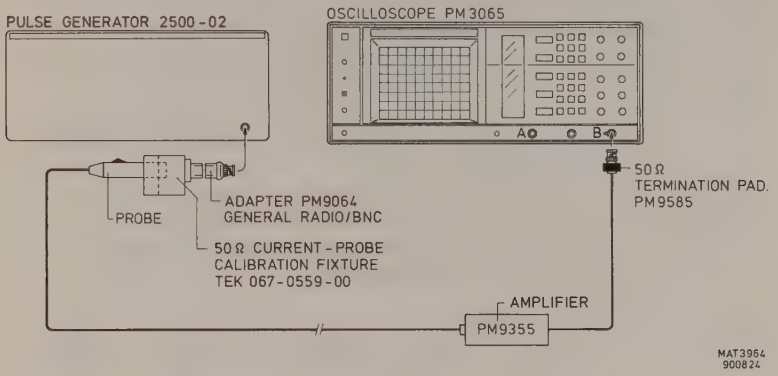

Figure 7.5 HF measuring set-up for combination

- Use measuring set-up according to figure 7.5.
- Set the oscilloscope controls to: AMPL/DIV B = 20 mV (channel A not used)
  TIME/DIV: 2 µs
- Set the generator to: - amplitude = 20 mA_{p-p} (4 divisions)
  - rise time 1 ns
- Press the 5 mA/DIV pushbutton on the amplifier box.
- Check the waveform for optimum square-wave response.

ADJ: if necessary, adjust potentiometers R221, R263 and trimmer C224.

- Ensure that the rise-time should not exceed 5 ns.

$$tr - probe = \sqrt{(tr - meas)^2 - (tr - scope)^2}$$

tr-scope = 3,5 ns

ADJ: if necessary, repeat the adjustment of Section 7.3.3.

- Press the 50 mA/DIV pushbutton on the amplifier box.
- Increase the amplitude of the generator to 300 mA_{p-p} (15 V_{p-p} across 50 Ω).
- Check the waveform for optimum square-wave response.

ADJ: if necessary, adjust trimmer C203.

- Press the 0,5 A/DIV pushbutton on the amplifier box.
- Set AMPL/DIV of channel B of the oscilloscope to 5 mV/DIV.
- Ensure that the trace height is 2,4 divisions.
- Check the waveform for optimom square-wave response.

ADJ: if necessary, adjust potentiometer R211.

- Decrease the amplitude of the generator to 4 mA $_{p-p}$.
- Press the 1 mA/DIV pushbutton on the amplifier box.
- Set AMPL/DIV of channel B of the oscilloscope to 20 mV/DIV.
- Set the Y deflection coefficient of the oscilloscope to 20 mV/DIV.
- Check the waveform for optimom square-wave response.

ADJ: if necessary, adjust potentiometer R266 and trimmer C227.

- Ensure that the rise-time should not exceed 8 ns.

$$tr - probe = \sqrt{(tr - meas)^2 - (tr - scope)^2}$$

tr-scope = 3,5 ns

7.3.2.4 Checking the bandwidth

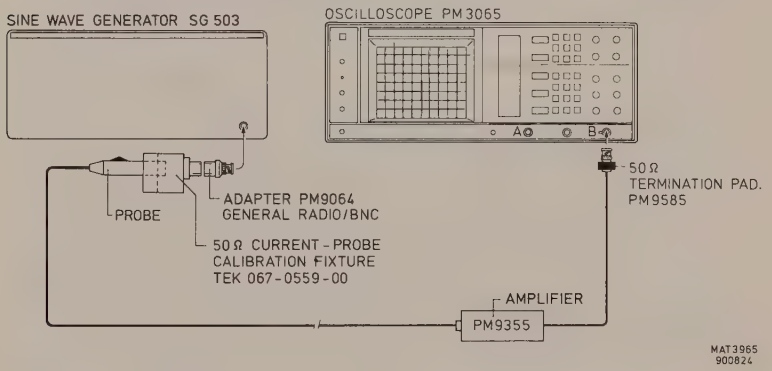

Figure 7.6 Bandwidth measuring set-up

- Use measuring set-up according to figure 7.6
- Set the oscilloscope controls to: AMPL/DIV B = 20 mV (channel A not used)
  TIME/DIV: 2 µs
- Set the generator to: - frequency = 50 kHz
- Press the 5 mA/DIV pushbutton on the amplifier box.
- Set the trace height on the oscilloscope to 6 divisions (1,5 V_{pp} across 50 Ω) by means of the generator amplitude cont rol.
- Increase the frequency of the generator until the trace height is 4,2 divisions.
- Ensure that the frequency of the input current is at least 70 MHz.

- Set the frequency of generator to 50 kHz again.
- Press the 2 mA/DIV pushbutton on the amplifier box.
- Set the trace height on the oscilloscope to 6 divisions (0,6 V_{pp} across 50 Ω) by means of the generator amplitude control.
- Increase the frequency of the generator until the trace height is 4,2 divisions.
- Ensure that the frequency of the input current is at least 45 MHz.
- Set the frequency of generator to 50 kHz again.
- Press the 1 mA/DIV pushbutton on the amplifier box.
- Set the trace height on the oscilloscope to 6 divisions (0,3 V_{pp} across 50 Ω) by means of the generator amplitude control.
- Increase the frequency of the generator until the trace height is 4,2 divisions.
- Ensure that the frequency of the input current is at least 45 MHz.

8 CORRECTIVE MAINTENANCE

8.1 REPLACEMENTS

8.1.1 Standard parts

Electrical and mechanical replacement parts can be obtained through your local Philips/Fluke organisation or representative. However, many of the standard electronic components can be obtained from other local suppliers.
Before purchasing or ordering replacement parts, check the parts list for value tolerance, rating and description.

NOTE: Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade the instrument's performance.

8.1.2 Special parts

In addition to the standard electronic components, some special components are used.
- Components, manufactured or selected by Philips to meet specific performance requirements.
- Components which are important for the safety of the instrument.

ATTENTION: Both type of components may only be replaced by components obtained through your local Philips/Fluke organisation or representative.

8.1.3 Transistors and integrated circuits

Transistors and IC's (integrated circuits) should not be replaced unless they are actually defective. Unnecessary replacement or exchanging of semiconductor devices may affect the calibration of the instrument. When a transistor is replaced, check the operation of the part of the instrument that may be affected.

Any replacement component should be of the original type or a direct replacement.

8.2 DISMANTLING THE AC CURRENT PROBE

- Loosen screw B.
- Push with the screw B the nut B out of the strain relief boor A, so far that both, the screw B and the nut B can be removed with a pair of pliers.
- Heat the probe connection to about 40 °C by means of e.g. a hairdrier so that the rubber is softened.
- Hold the tail piece C with one hand on its fixed position and withdraw the strain relief boot with the other hand in the direction of the arrow.
- Slightly lift tail piece C and pull it out of the slider, together with the spring D.
- Pull the slider back until its securing notch at the nose of the clip-on transformer is free.
- With the aid of a knife, bend both sides of the clip-on transformer casing at points E and lift the notches at the side of the slider out of the guiding slots.
- Take the slider out of the casing

NOTE: Mind the moveable part of the transformer core which is loose in the slider.

- Remove screw F which secures the printed circuit board (pcb).
- Lever the stationary part of the transformer core together with the printed-wiring board out of the casing; the stationary part of the transformer core plugs into the socket on the pcb.

To re-assamble the current probe, proceed in reverse order.

ATTENTION: Before the clip-on current transformer is re-assembled, the contact areas of the transformer cores must be cleaned with a soft cloth and pain water or alcohol and not be touched again. We recommend to clean the contact areas at regular intervals.

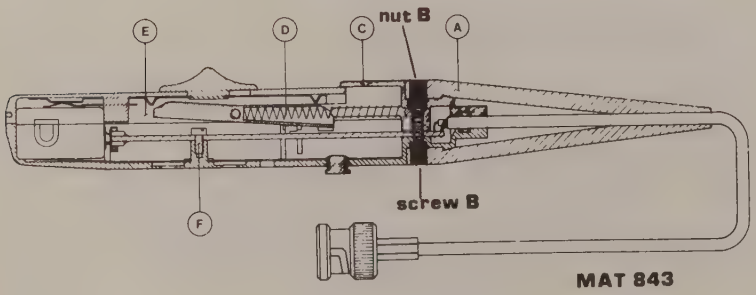

Figure 8.1 Dismantling the AC current probe

8.3 REMOVING THE AMPLIFIER PCB

- Dismantle the amplifier box (see Section 6.2).
- Remove the two screws "A" (see figure 8.2) which secure the pcb to the front panel by means of an ALLAN key.
- Unsolder the capacitors C247 and C248 (mounted between cabinet earth and circuit earth).
- Unsolder the cable connections and the BNC socket connection.
- Unscrew the BNC connector.
- Remove the two screws "B".
- The pcb can then be removed by moving the frame backwards.

NOTE: Before the pcb is refitted to the front panel, it is advisable to stick the two parts of the clamping device together by means of adhesive tape or non-hardering glue, in order to facilitate replacement (refer to figure 8.4).

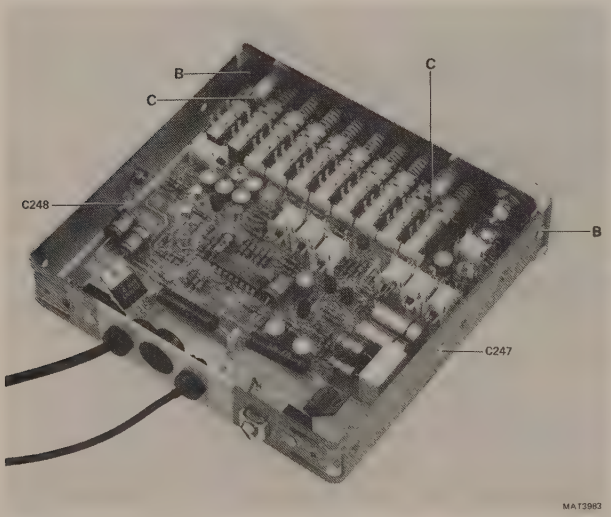

Figure 8.2 Dismanteling the amplifier

8.4 REPLACING A PUSHBUTTON SWITCH-SEGMENT

- Remove the pcb for replacing a switch in this unit (see section 8.3).
- Straighten the four retaining lugs of the relevant switch as shown in figure 8.3.
- Break the body of the relevant switch by means of a pair of pliers and remove the pieces. The soldering pins are then accessible.
- Remove the soldering pins and clean the holes in the pcb.
- Solder the new switch onto the pcb.
- Band the four retaining lugs to their original positions.

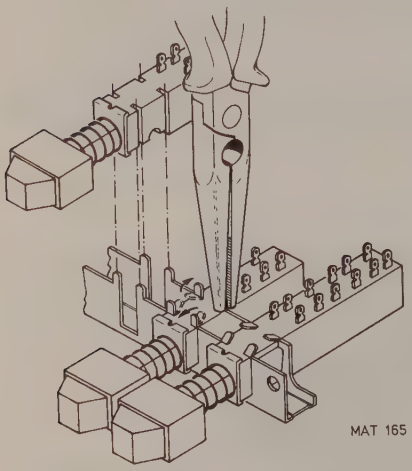

Figure 8.3 Replacing a switch-segment of a pushbutton set

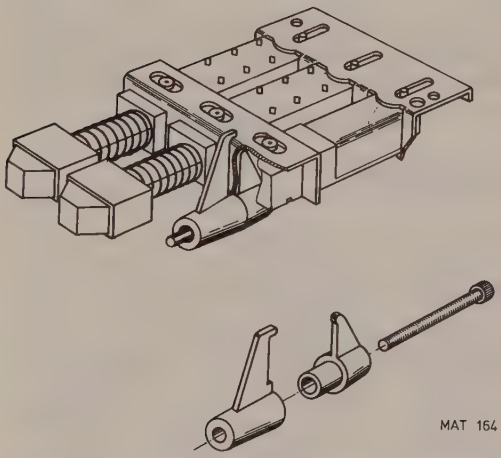

Figure 9.4 Pushbutton set clamping device

8.5 REPLACING A REED-RELAY CONTACT

The reed relay contact tubes are soldered on two wires, (length 6 mm) which are soldered vertical on the amplifier pcb. They are mounted in this way to prevent that the glass tube breaks when its connection-wires are bent for mounting on the amplifier pcb.
For replacing, take care of the following:

- Cut the connection wires of the reed-relay contact at a length of 4 mm.
- Slide the glass tube carefully in the relay coil.
- To prevent that the glass tube will be damaged when it is soldered on the two vertical wires, the distance between the soldering-point and the glass tube must be minimum **3 mm** (isolation tube).
- The soldering-time must be not longer than **5 seconds** at a temperature of maximum **260 °C**.

8.6 MAINS ADAPTER REPAIR

Since the mains adapter is non-repairable, it can be ordered as one complete service item. Different types (European, North-American or Brittish) are available for the various mains (line) outlets. Ordering numbers of the mains adapters are given in section 9.1 of this manual.

8.7 INSTRUMENT REPACKING

If the instrument is to be shipped to a Service Centre for service or repair, attach a tag showing the full address and the name of the individual at the users firm that can be contacted. The Service Centre needs the complete instrument, its serial number and a fault description.
If the original packing is not available, repack the instrument in such a way that no damage occurs during transport.

8.8 MAINTENANCE

The AC current probe and amplifier generally requires no maintenance, since none of its components is subject to wear. However, to ensure reliable and trouble free operation, the instrument should not exposed to moisture, heat, corrosive elements or excessive dust.

9 PARTS LIST

(Subject to alteration without notice)

9.1 MECHANICAL PARTS

9.1.1 Mechanical parts on AC current probe

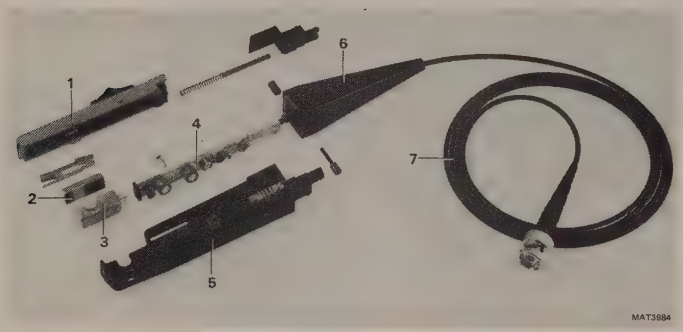

Figure 9.1 Mechanical parts on AC current probe

Item	Qty	Ordering code	Decription
1	1	5322 447 91809	Cover with slider
2	1	5322 142 74006	Moving part of core
3	1	5322 142 70072	Stationary part of core
4	1	5322 216 94107	Probe unit pcb
5	1	5322 447 91811	Housing complete
6	1	5322 325 54066	Strain relief boot
7	1	5322 321 24555	Cable with BNC
8	1	5322 321 20223	Ground lead (not shown)

9.1.2 Mechanical parts on Amplifier box

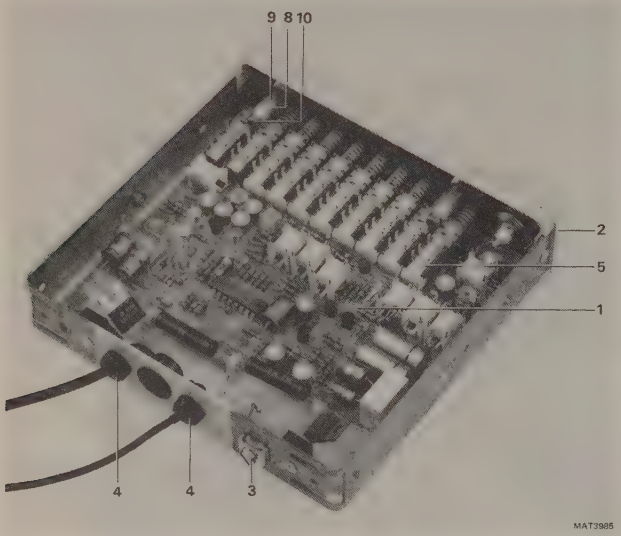

Figure 9.2 Mechanical parts inside amplifier box

Item	Qty	Ordering code	Description
1	1	5322 216 94201	Amplifier unit pcb complete
2	1	5322 459 60537	Ornamental frame
3	1	5322 405 94046	Earth clip
4	2	5322 325 64085	Grommet (mounted in amplifier-frame for the output cables)
5	1	5322 276 84041	Pushbutton switch unit complete
--	10	5322 276 14101	Single pushbutton switch segment
--		5322 466 85843	Support for max. 11 switches (must be sawn on required size)
6	2	5322 405 94175	Male clamping piece
7	2	5322 405 94176	Female clamping piece
8	2	5322 502 11142	Screw for clamping pieces

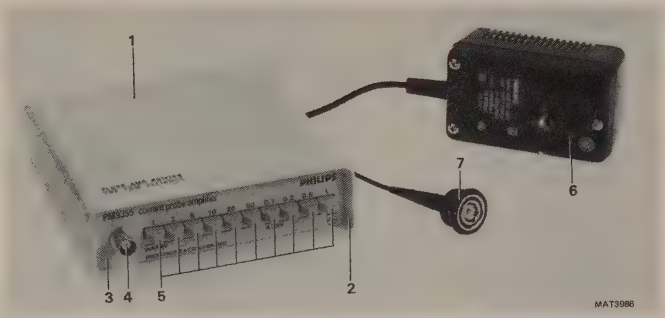

Figure 9.3 Mechanical parts on amplifier box and accessories

Item	Qty	Ordering code	Description
1	1	5322 447 91805	Amplifier cabinet
2	1	5322 460 60537	Ornamental frame
3	1	5322 455 81133	Text plate
4	1	5322 267 10004	BNC
5	10	5322 414 40059	Knob for pushbutton
6	1	5322 693 84001	Mains adapter (European)
		5322 693 84002	Mains adapter (North American)
		5322 263 50145	Mains adapter (Brittish)
7	1	5322 320 14026	Output cable with BNC
--	1	5322 600 30038	Carrying case (not shown)

9.2 ELECTRICAL PARTS

CAPACITORS:

POSNR	DESCRIPTION	ORDERING CODE
C0001	5,5-40P	5322 125 50231
C0201	15 pF 2%	4822 122 31823
C0202	47 pF 2%	4822 122 31072
C0203	2/18 pF 300V	5322 125 50051
C0204	470 pF 10%	4822 122 30034
C0205	10 nF -20+80%	4822 122 30043
C0206	330 uF 10% 6V	5322 124 14054
C0207	330 uF 10% 6V	5322 124 14054
C0208	1,5 uF -10+50%	4822 124 20723
C0209	22 nF -20+80%	4822 122 30103
C0211	150 uF -10+50%	4822 124 20672
C0213	8,2 pF 0,25 pF	4822 122 31052
C0214	10 nF -20+80%	4822 122 30043
C0216	150 uF -10+50%	4822 124 20672
C0217	22 nF -20+80%	4822 122 30103
C0218	1 uF 10% 100V	5322 121 40197
C0219	22 nF -20+80%	4822 122 30103
C0221	330 pF 10%	4822 122 30055
C0222	22 nF -20+80%	4822 122 30103
C0223	22 nF -20+80%	4822 122 30103
C0224	2/18 pF 300V	5322 125 50051
C0226	18 pF 2%	4822 122 31061
C0227	2/18 pF 300V	5322 125 50051
C0229	22 nF -20+80%	4822 122 30103
C0231	22 nF -20+80%	4822 122 30103
C0232	22 uF -10+50%	4822 124 20698
C0233	22 nF -20+80%	4822 122 30103
C0234	22 nF -20+80%	4822 122 30103
C0236	22 nF -20+80%	4822 122 30103
C0237	100 uF -10+50%	4822 124 20701
C0238	22 nF -20+80%	4822 122 30103
C0239	22 nF -20+80%	4822 122 30103

POSNR	DESCRIPTION			ORDERING CODE
C0241	100 uF -10+50%			4822 124 20701
C0242	220 nF 10% 100V			4822 121 40427
C0243	220 nF 10% 100V			4822 121 40427
C0247	22 nF -20+80%			4822 122 30103
C0248	22 nF -20+80%			4822 122 30103
RESISTORS:				
R0001	1K	20%	0.75W	5322 100 10143
R0002	1K	20%	0.75W	5322 100 10143
R0126	46,7E	1%	MR16T	5322 116 53106
R0127	46,4E	1%	MR16T	5322 116 53106
R0201	49E9	1%	MR25	5322 116 54441
R0202	220E	20%	0.75W	5322 100 10133
R0203	11E	5%	0,25W	5322 111 44174
R0204	10E	5%	0,25W	5322 111 44175
R0206	44E2	1%	MR25	5322 116 50818
R0207	44E2	1%	MR25	5322 116 50818
R0209	487E	1%	MR25	5322 116 55451
R0211	220E	20%	0.75W	5322 100 10135
R0212	40E2	1%	MR25	5322 116 50926
R0213	44E2	1%	MR25	5322 116 50818
R0214	422E	1%	MR25	5322 116 50459
R0216	422E	1%	MR25	5322 116 50459
R0217	442E	1%	MR25	5322 116 50592
R0218	3K48	1%	MR25	5322 116 55367
R0219	147E	1%	MR25	5322 116 50766
R0221	1K	20%	0.75W	5322 100 10143
R0222	4K7	20%	0.75W	5322 100 10139
R0223	1K	1%	MR25	4822 116 51235
R0224	619E	1%	MR25	4822 116 51232
R0226	33E2	1%	MR25	5322 116 50527
R0227	16K2	1%	MR25	5322 116 55361
R0229	1K69	1%	MR25	5322 116 54567
R0231	154E	1%	MR25	5322 116 50506
R0232	33E2	1%	MR25	5322 116 50527
R0233	48E7	1%	MR25	5322 116 50511

POSNR	DESCRIPTION			ORDERING CODE
R0234	1K	1%	MR25	4822 116 51235
R0236	100E	1%	MR25	5322 116 55549
R0237	2K37	1%	MR25	5322 116 54576
R0238	49E9	1%	MR25	5322 116 54441
R0239	12E7	1%	MR25	5322 116 54261
R0241	49E9	1%	MR25	5322 116 54441
R0242	51E1	1%	MR25	5322 116 54442
R0243	4K87	1%	MR25	5322 116 55445
R0244	383E	1%	MR25	5322 116 55368
R0246	2K37	1%	MR25	5322 116 54576
R0247	590E	1%	MR25	5322 116 50561
R0248	14K7	1%	MR25	5322 116 54632
R0249	4K99	1%	MR25	5322 116 50523
R0251	4K99	1%	MR25	5322 116 50523
R0252	100K	20%	0.75W	5322 100 10142
R0253	1K21	1%	MR25	5322 116 54557
R0254	383E	1%	MR25	5322 116 55368
R0256	100E	1%	MR25	5322 116 55549
R0257	33E2	1%	MR25	5322 116 50527
R0258	5K62	1%	MR25	4822 116 51281
R0259	2K15	1%	MR25	5322 116 50767
R0261	4K64	1%	MR25	5322 116 50484
R0262	1K	20%	0.75W	5322 100 10143
R0263	220E	20%	0.75W	5322 100 10133
R0264	220E	20%	0.75W	5322 100 10133
R0266	1K	20%	0.75W	5322 100 10143
R0268	6K19	1%	MR25	5322 116 55426
R0269	301E	1%	MR25	5322 116 55366
R0271	33E2	1%	MR25	5322 116 50527
R0272	909E	1%	MR25	5322 116 55278
R0273	17E8	1%	MR25	5322 116 50418
R0274	100E	1%	MR25	5322 116 55549
R0276	33E2	1%	MR25	5322 116 50527
R0277	3K16	1%	MR25	5322 116 50579
R0278	383E	1%	MR25	5322 116 55368

POSNR	DESCRIPTION			ORDERING CODE
R0279	2K37	1%	MR25	5322 116 54576
R0280	51E1	1%	MR25	5322 116 54442
R0281	2K37	1%	MR25	5322 116 54576
R0282	75K	1%	MR25	4822 116 51267
R0283	205E	1%	MR25	5322 116 55365
R0284	169E	1%	MR25	5322 116 54489
R0286	4E99	1%	MR25	5322 116 50568
R0287	4E99	1%	MR25	5322 116 50568
R0288	1K	5%	7W	4822 112 41107
R0289	2K2	5%	7W	4822 112 41063

SEMI-CONDUCTORS:

V0201	BAW62	4822 130 30613
V0202	BAW62	4822 130 30613
V0203	BF199	4822 130 44154
V0204	BF324	4822 130 41448
V0206	BC549	4822 130 40964
V0207	BC548C	4822 130 44196
V0208	BFY90	4822 130 40493
V0209	BCY71	5322 130 40373
V0211	BZX79-C5V6	4822 130 34173
V0212	BF324	4822 130 41448
V0213	BFY90	4822 130 40493
V0214	BCY71	5322 130 40373
V0216	BZX79-C9V1	4822 130 30862
V0217	BZX79-C9V1	4822 130 30862

INTEGRATED CIRCUITS:

D0201	TCA220	5322 209 84386
D0202	UA7912UC	5322 209 81179
D0203	UA7812UC	5322 209 86176

POSNR	DESCRIPTION	ORDERING CODE
MISCELLANEOUS:		
L0126	Coil	5322 158 14127
L0127	Coil	5322 158 14127
L0128	Coil	5322 158 14129
L0129	Coil	5322 158 14128
L0201	Coil 100 µH	5322 158 10243
L0202	Coil 100 µH	5322 158 10243
L0203/R0208	Coil Assy	5322 158 14216
K0201	Reed relay coil 6 V	5322 280 24076
K0201	Reed relay contact	5322 280 24126
K0202	Reed relay coil 6 V	5322 280 24076
K0202	Reed relay contact	5322 280 24126
K0203	Reed relay coil 6 V	5322 280 24076
K0203	Reed relay contact	5322 280 24126
K0204	Reed relay coil 6 V	5322 280 24076
K0204	Reed relay contact	5322 280 24126
K0206	Reed relay coil 6 V	5322 280 24076
K0206	Reed relay contact	5322 280 24126
K0207	Reed relay coil 6 V	5322 280 24076
K0207	Reed relay contact	5322 280 24126
K0208	Reed relay coil 6 V	5322 280 24076
K0208	Reed relay contact	5322 280 24126
K0209	Reed relay coil 6 V	5322 280 24076
K0209	Reed relay contact	5322 280 24126

10 CIRCUIT DIAGRAM AND PCB LAY-OUTS

The following pages give the overall circuit diagram of the AC current probe and amplifier. It gives also the pcb lay-outs of the probe unit and the amplifier unit.

Since the mains adapter is a non-repairable unit, the components of this unit are **not** shown in the circuit diagram

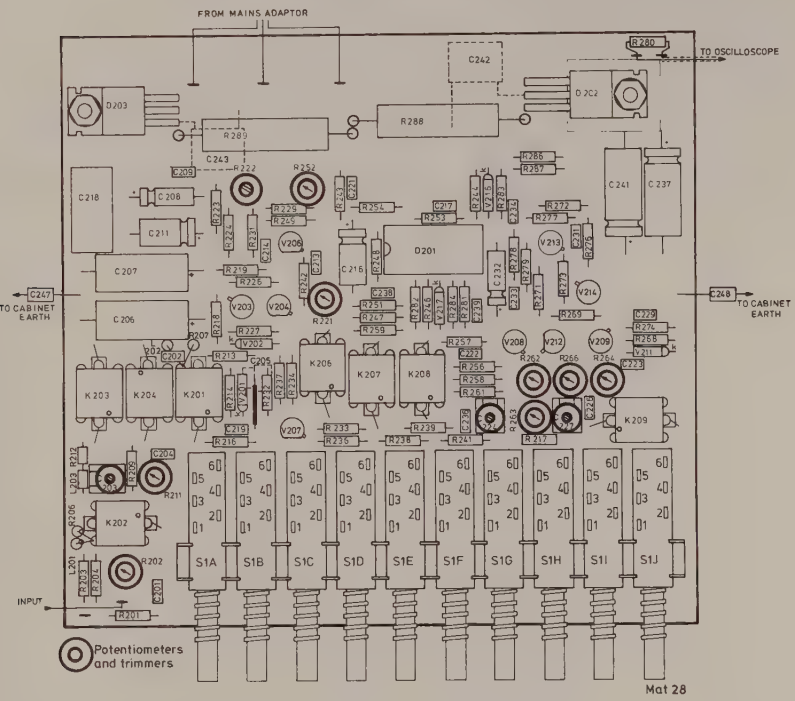

Figure 10.1 Amplifier unit pcb

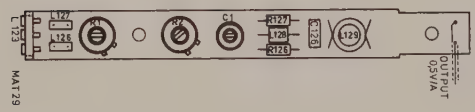

Figure 10.2 Probe unit pcb

POSITION OF SWITCH S1	mA/DIV						A/DIV			
	1	2	5	10	20	50	.1	.2	.5	1
ENERGISED RELAYS K	201	201	201	201	201	202	202	202	202	202
	206	207	206	207	208	203	203	203	204	204
	209	209				206	207	208	206	207

MAT 842

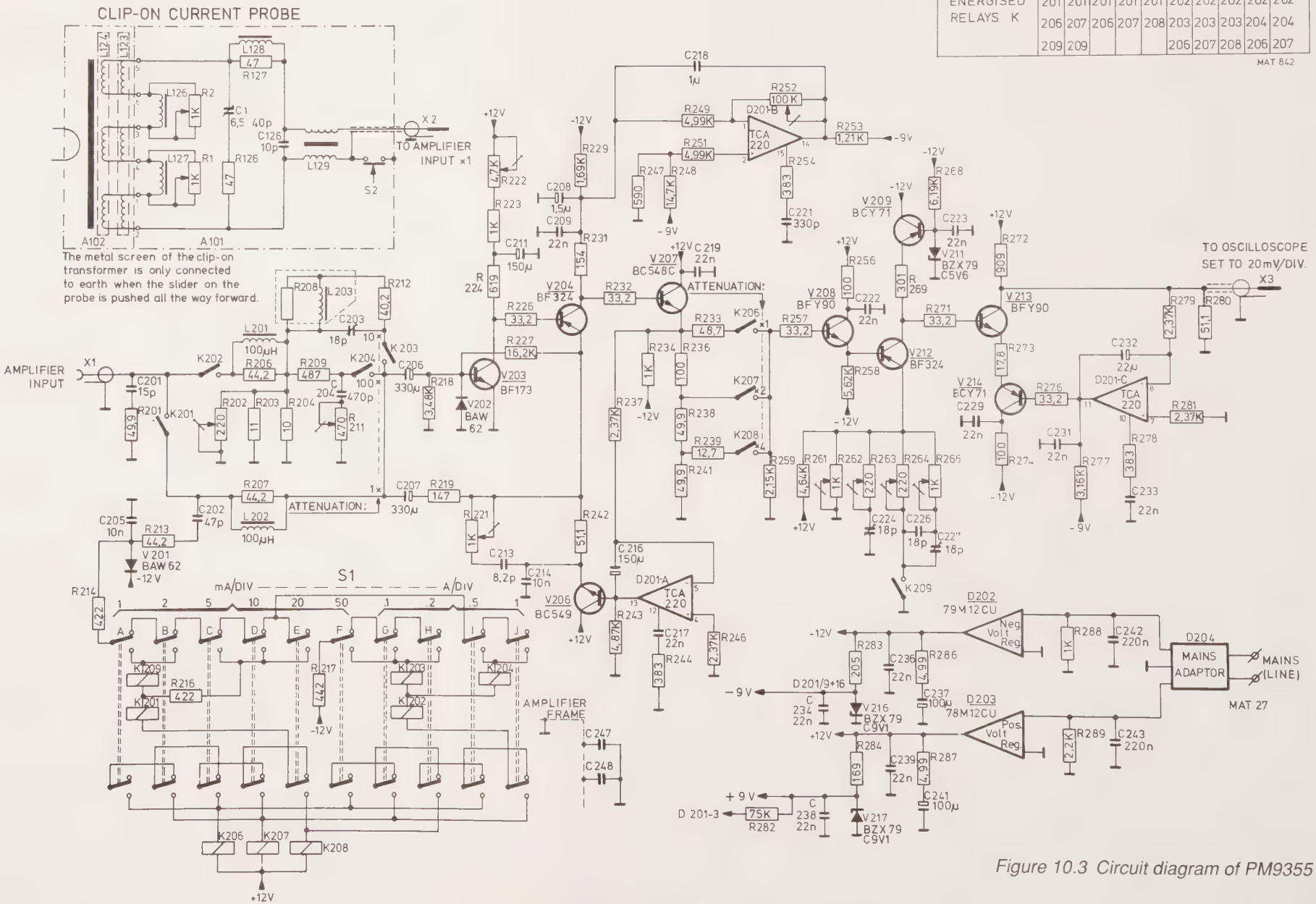

Figure 10.3 Circuit diagram of PM9355

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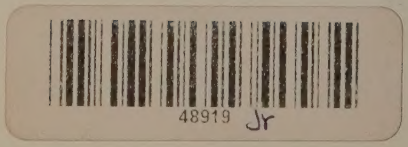
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